

Fig.1

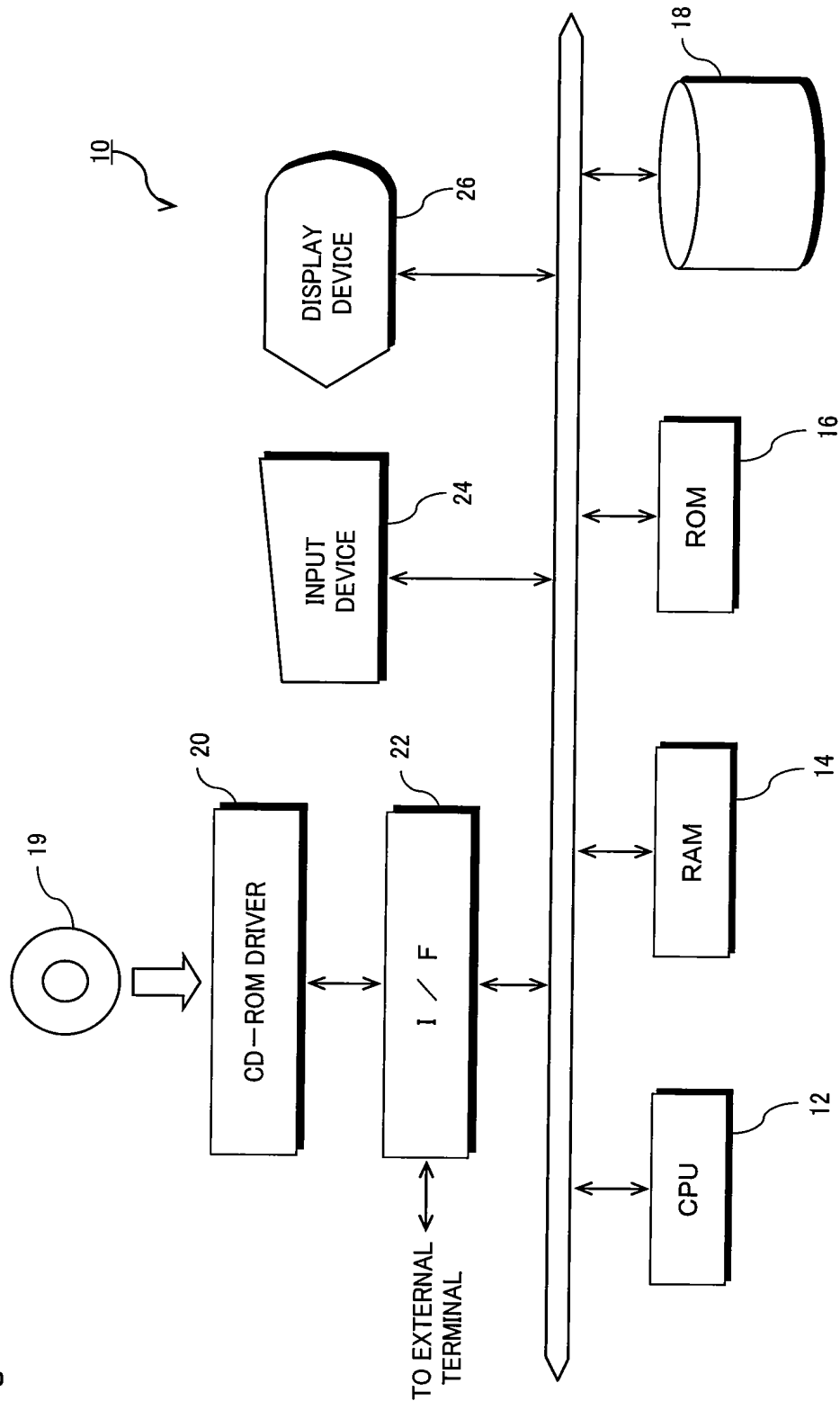


Fig.2A

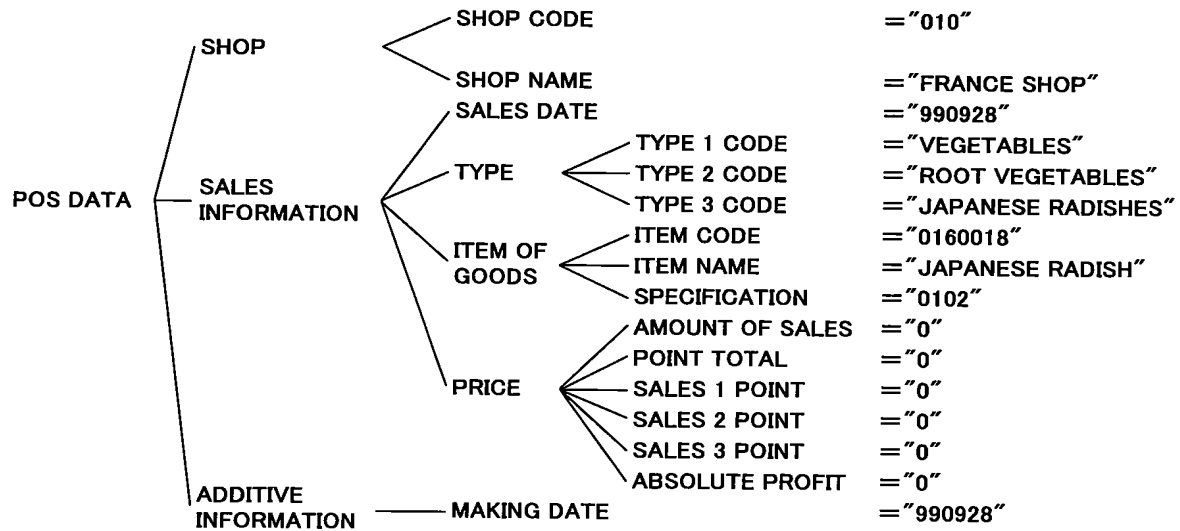


Fig.2B

```

<posdata>
  <shop>
    <shopCode>010</shopCode>
    <shopName>FRANCE SHOP</shopName>
  </shop>
  <salesInformation>
    <sellDate>990928</sellDate>
    <class>
      <class1 code="01">VEGETABLES</class1>
      <class2 code="01">ROOT VEGETABLES</class2>
      <class3 code="01">JAPANESE RADISHES</class3>
    </class>
    <goods>
      <goodsCode>"0160018"</goodsCode>
      <goodsName>JAPANESE RADISH</goodsName>
      <standard>0102</standard>
    </goods>
    <price>
      <amountOfSales>0</amountOfSales>
      <amountOfPoints>0</amountOfPoints>
      <sales1 point="0">0</sales1>
      <sales2 point="0">0</sales2>
      <sales3 point="0">0</sales3>
      <grossProfit>0</grossProfit>
    </price>
  </salesInformation>
  <additionalInformation>
    <createdDate>990928</createdDate>
  </additionalInformation>
</posdata>
  
```

Fig.3A

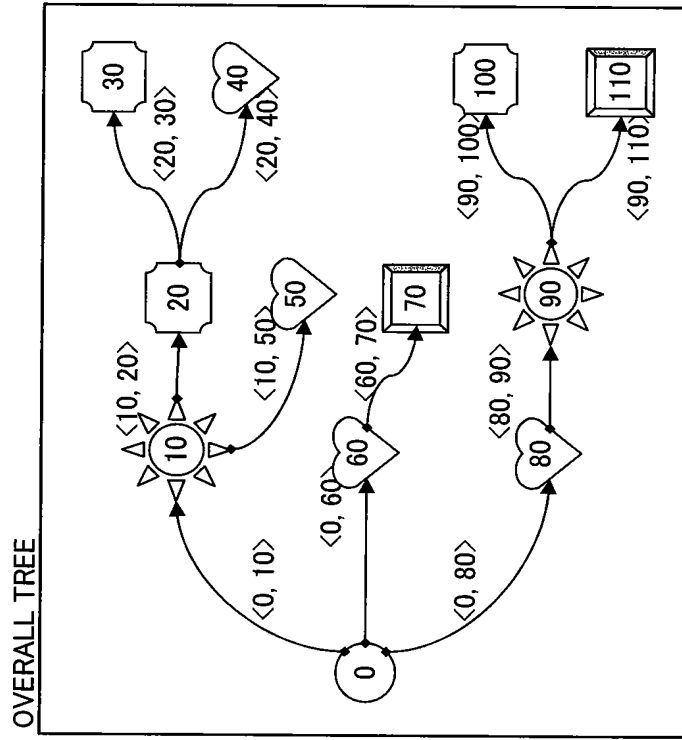


Fig.3B

ARC LIST

From-ID	To-ID
0	10
1	0
2	0
3	10
4	10
5	20
6	20
7	60
8	60
9	80
10	90
11	90

Fig.3C

NODE LIST

ID	Type
0	Root
1	Sun
2	Sqr
3	Sqr
4	Heart
5	Heart
6	Heart
7	Btn
8	Heart
9	Sun
10	Sqr
11	Btn

Fig.4A

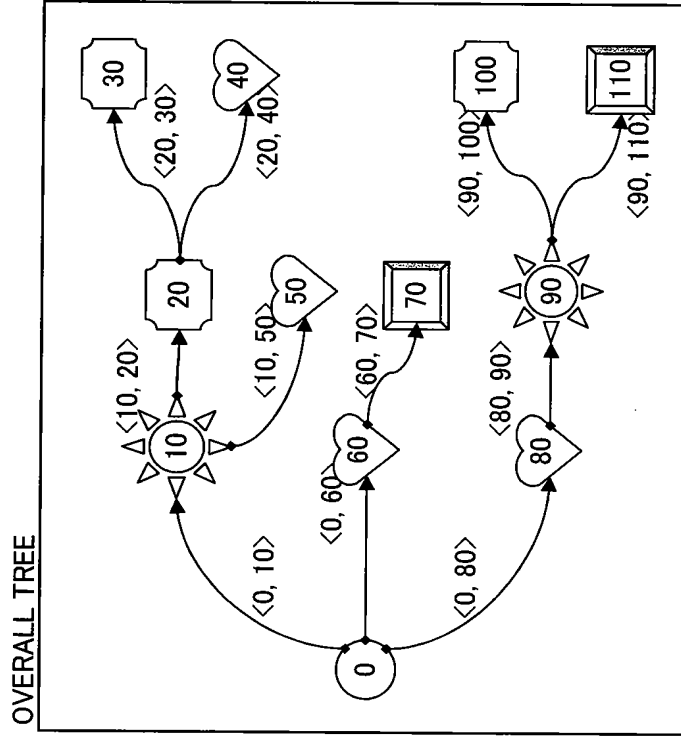


Fig.4B

ARC LIST:  
"CHILD→PARENT"  
RELATIONSHIP

To-ID	From-ID
0	-
10	0
20	10
30	20
40	20
50	10
60	0
70	60
80	0
90	80
100	90
110	90

Fig.4C

ARC LIST:  
"CHILD→PARENT"  
RELATIONSHIP

To-ID	From-ID
10	0
20	10
30	20
40	20
50	10
60	0
70	60
80	0
90	80
100	90
110	90

Fig.5

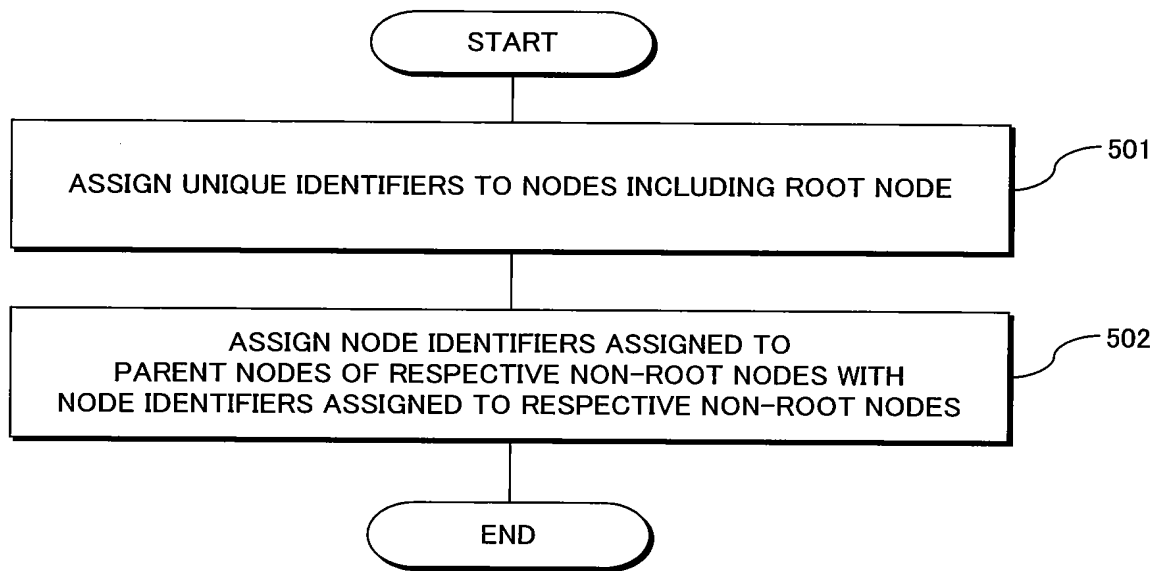


Fig.6A

DESCRIPTION BASED ON ID

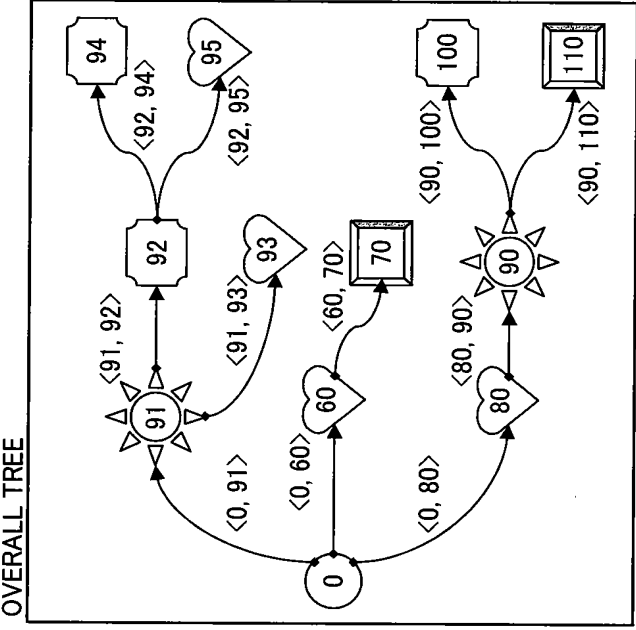


Fig.6B

ID→No.	0	1	2	3	4	5	6	7	8	9	10	11
CONVERSION TABLE	→	→	→	→	→	→	→	→	→	→	→	→
0	91	92	93	94	95	60	70	80	90	100	110	

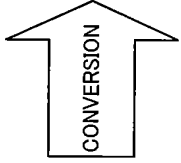


Fig.6C

DESCRIPTION BASED ON No. (DEPTH-FIRST)

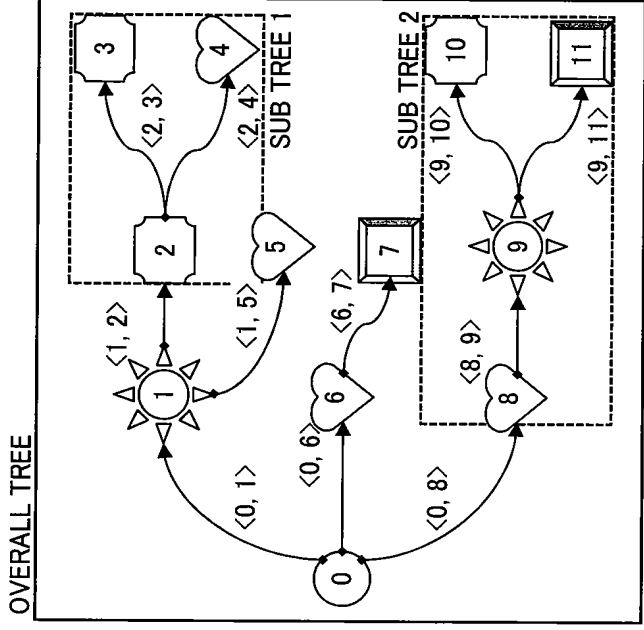


Fig.7A

DESCRIPTION BASED ON ID

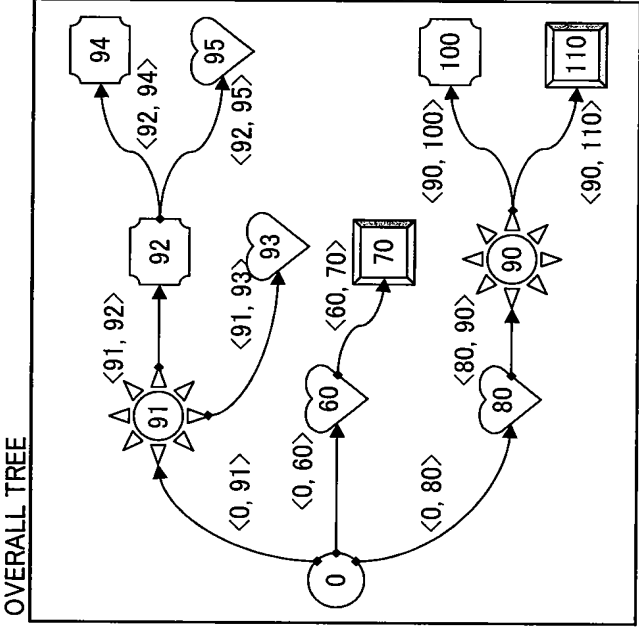


Fig.7B

ID	→	No.
0	→	0
91	→	1
92	→	4
93	→	5
94	→	8
95	→	9
60	→	2
70	→	6
80	→	3
90	→	7
100	→	10
110	→	11

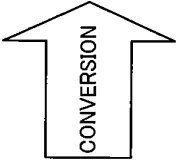


Fig.7C

DESCRIPTION BASED ON No. (WIDTH-FIRST)

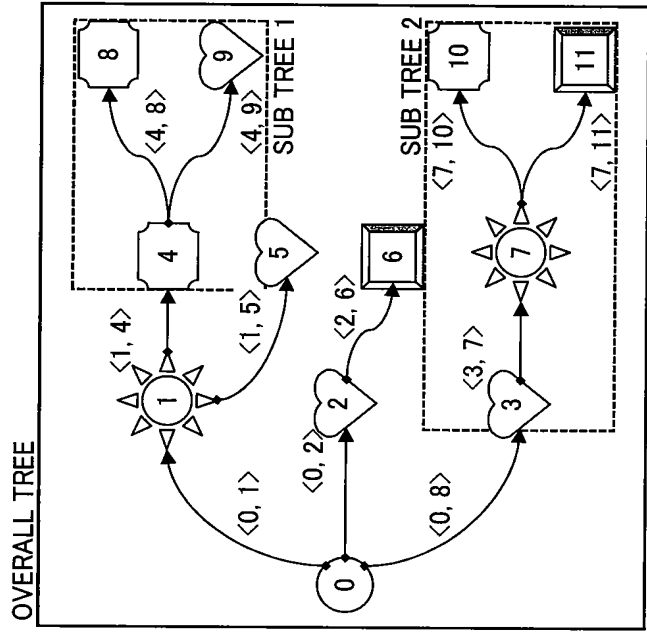
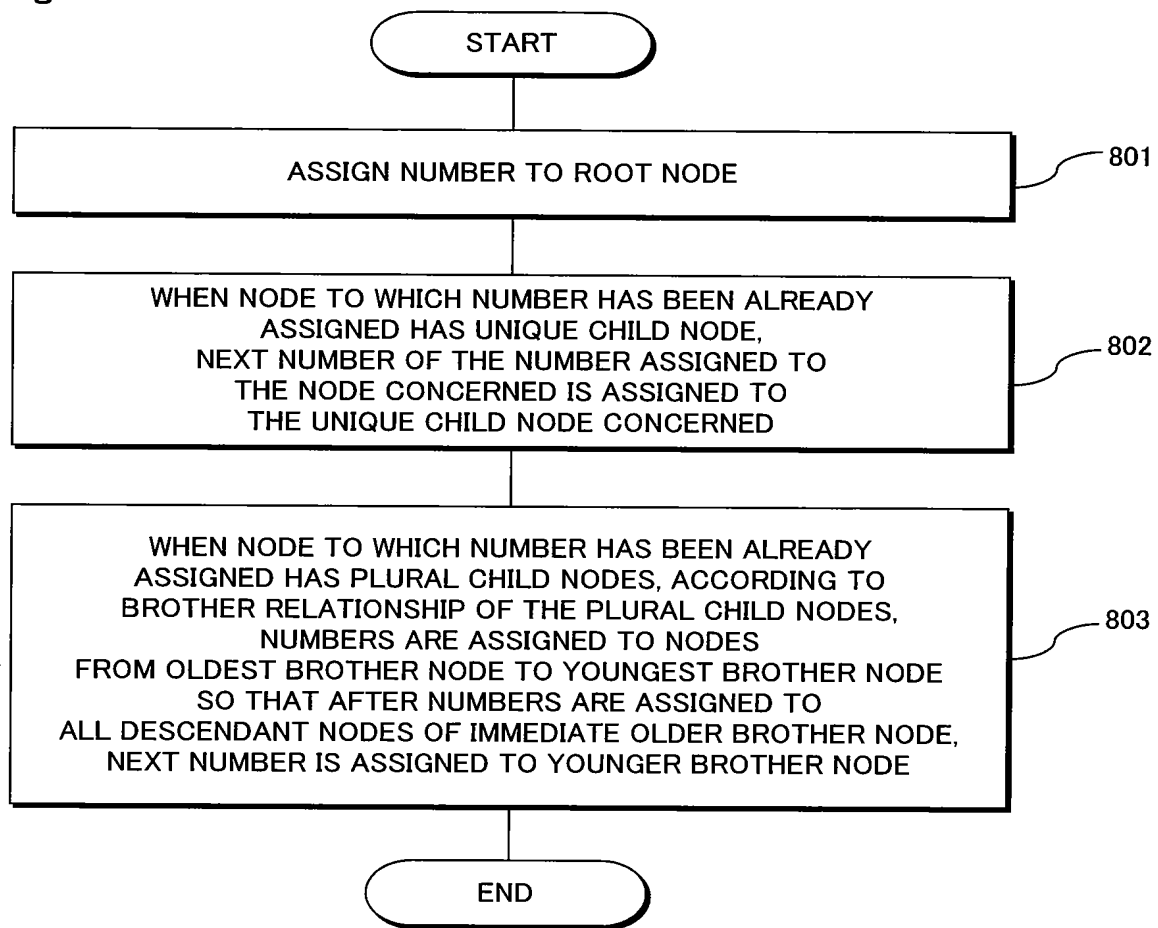


Fig.8





**Fig.9**

ARRAY OF PARENT-CHILD RELATIONSHIP  
BASED ON "CHILD→PARENT" RELATIONSHIP OF DEPTH-FIRST

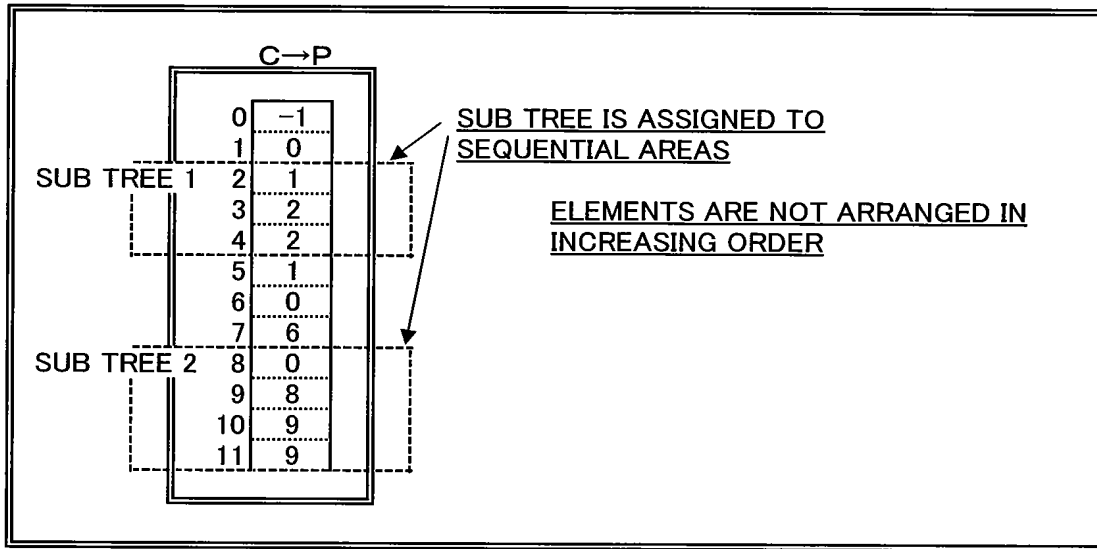


Fig.10

ARRAY OF PARENT-CHILD RELATIONSHIP  
BASED ON "PARENT→CHILD" RELATIONSHIP OF DEPTH-FIRST

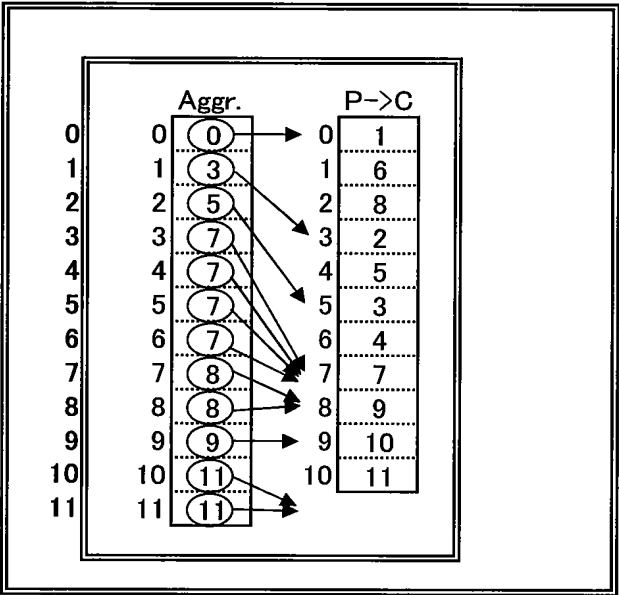


Fig.11

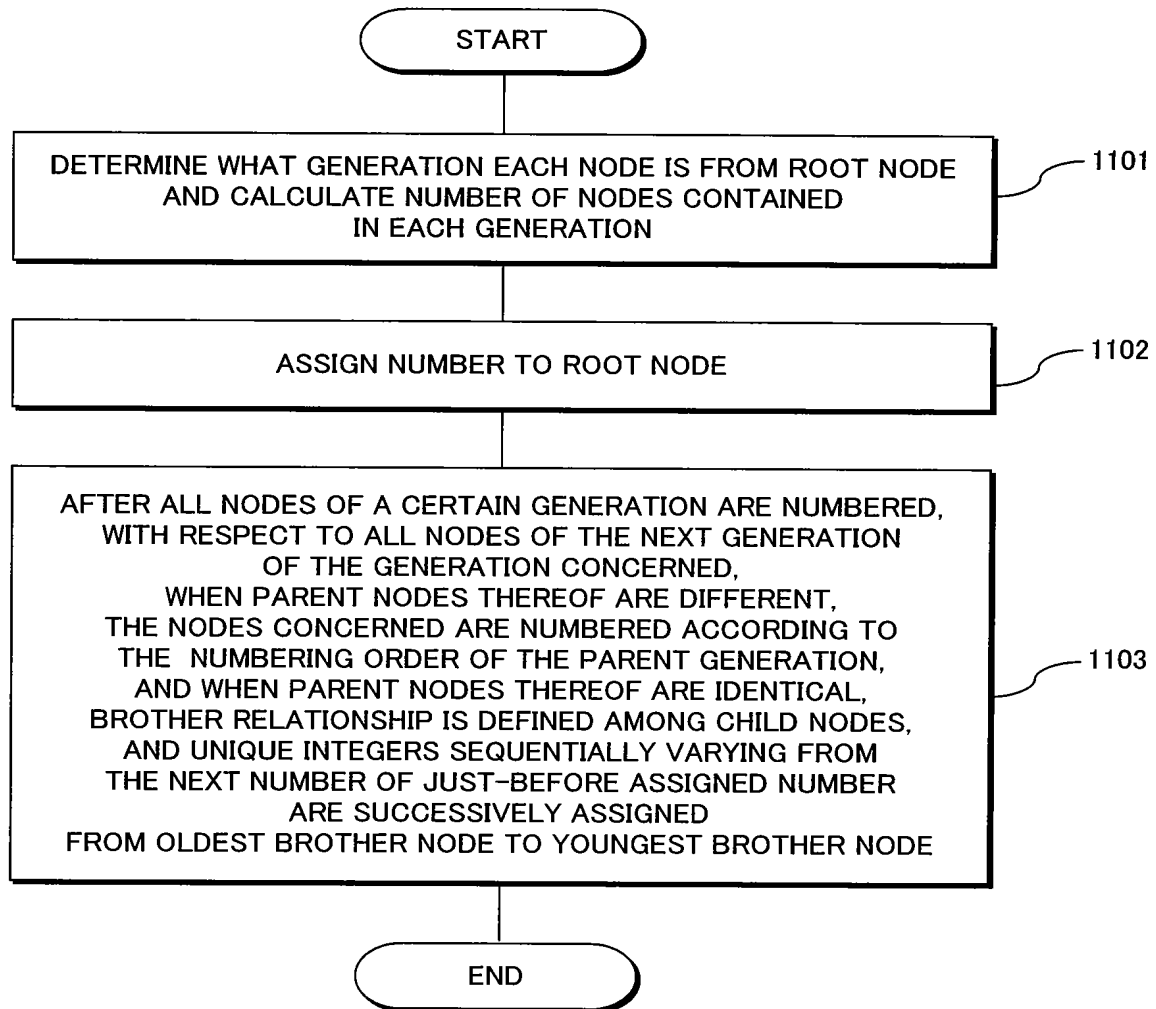


Fig.12

ARRAY OF PARENT-CHILD RELATIONSHIP  
BASED ON "CHILD→PARENT" RELATIONSHIP OF WIDTH-FIRST

ELEMENTS ARE ARRANGED IN INCREASING ORDER

EXPRESSION BASED ON CHILD→PARENT

C→P	
0	-1
1	0
2	0
3	0
4	1
5	1
6	2
7	3
8	4
9	4
10	7
11	7

CHILD NODES 1,2,3 OF PARENT NODE 0

CHILD NODES 4,5 OF PARENT NODE 1

CHILD NODES 8,9 OF PARENT NODE 4

CHILD NODES 10,11 OF PARENT NODE 7

**Fig.13**

ARRAY OF PARENT-CHILD RELATIONSHIP  
BASED ON "PARENT→CHILD" RELATIONSHIP OF WIDTH-FIRST

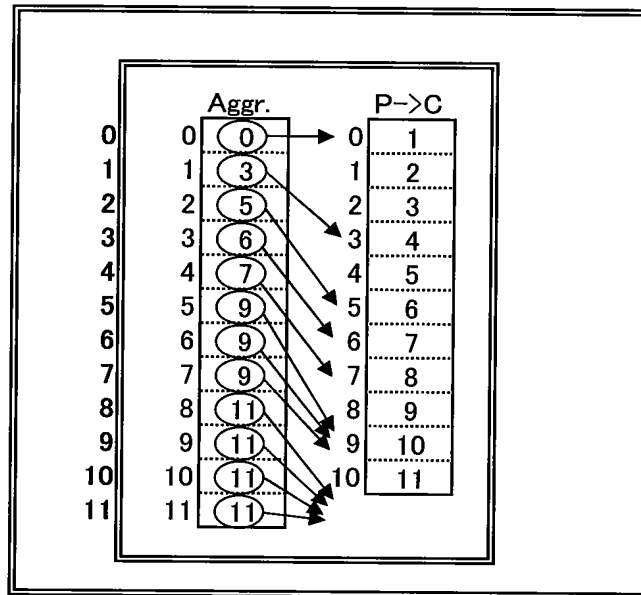


Fig.14

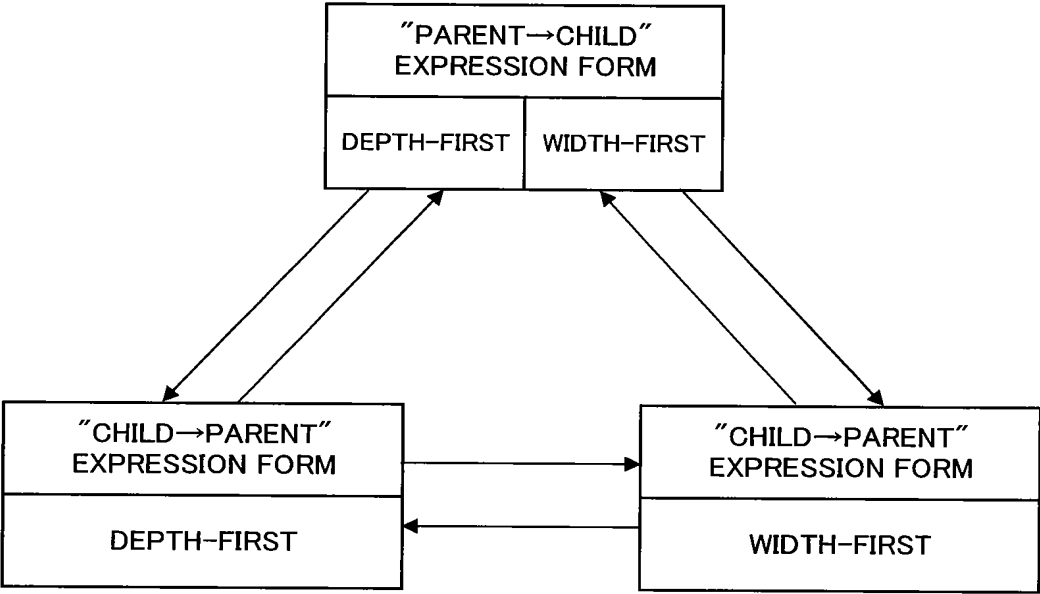


Fig.15

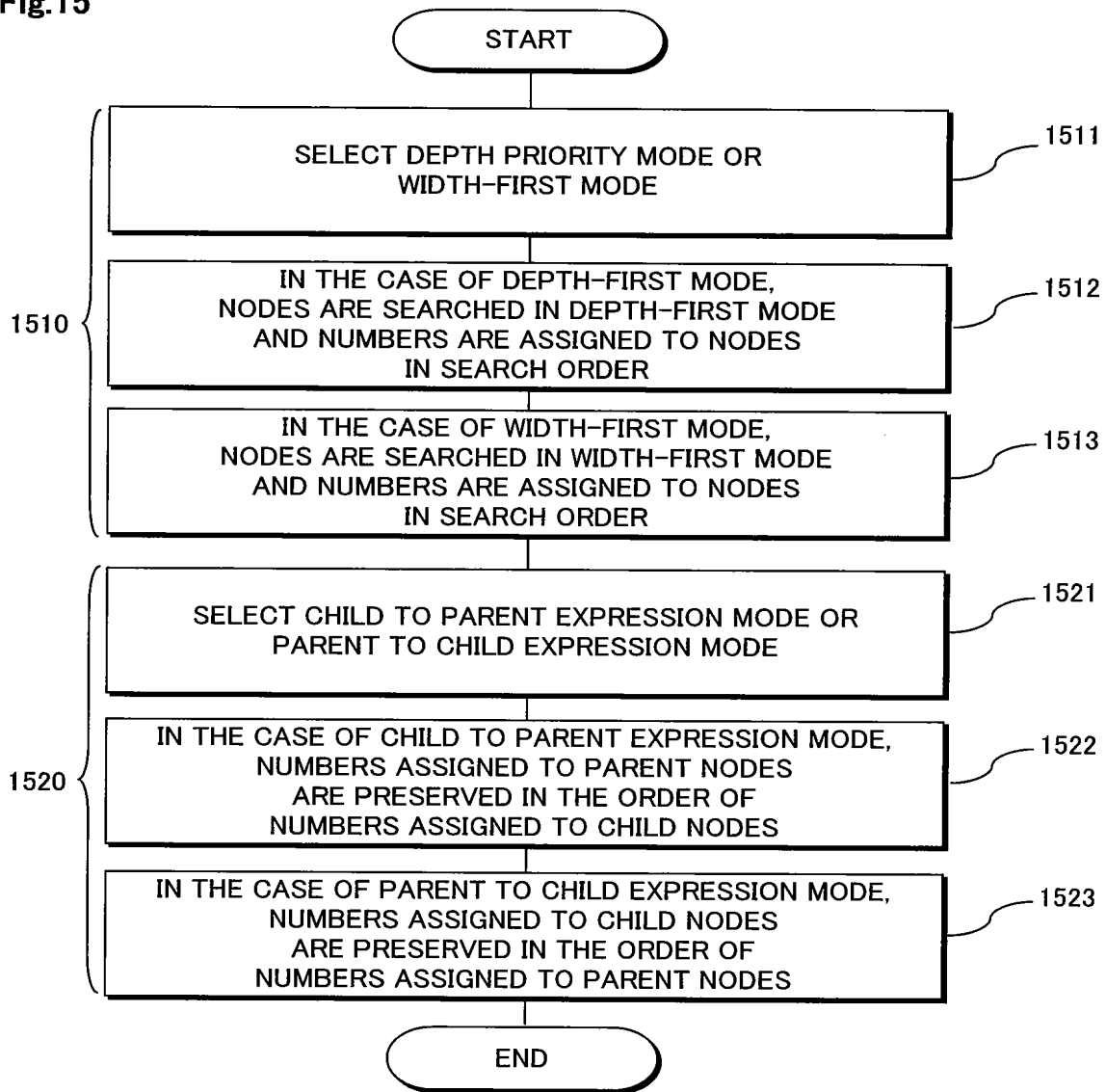


Fig.16A

DEPTH-FIRST "CHILD→PARENT" EXPRESSION

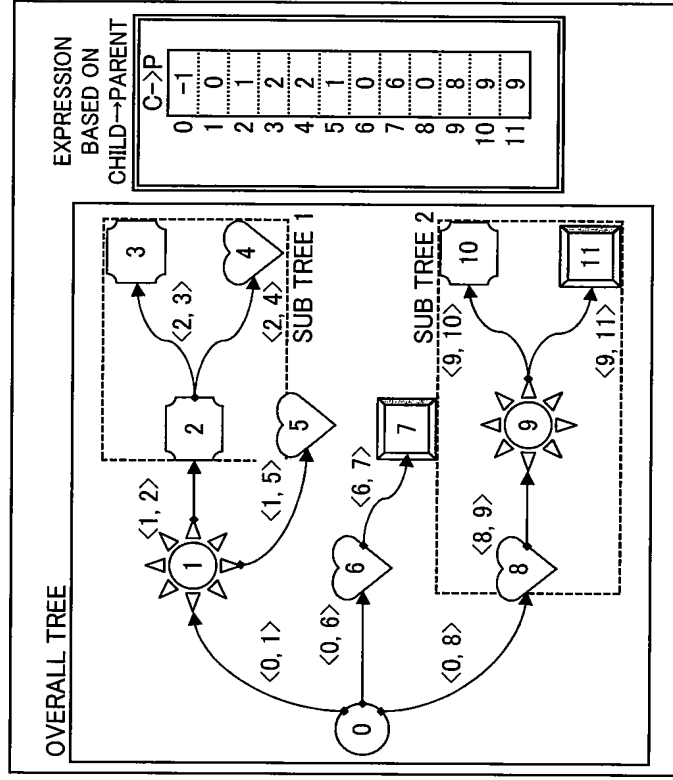


Fig.16B

WIDTH-FIRST "CHILD→PARENT" EXPRESSION

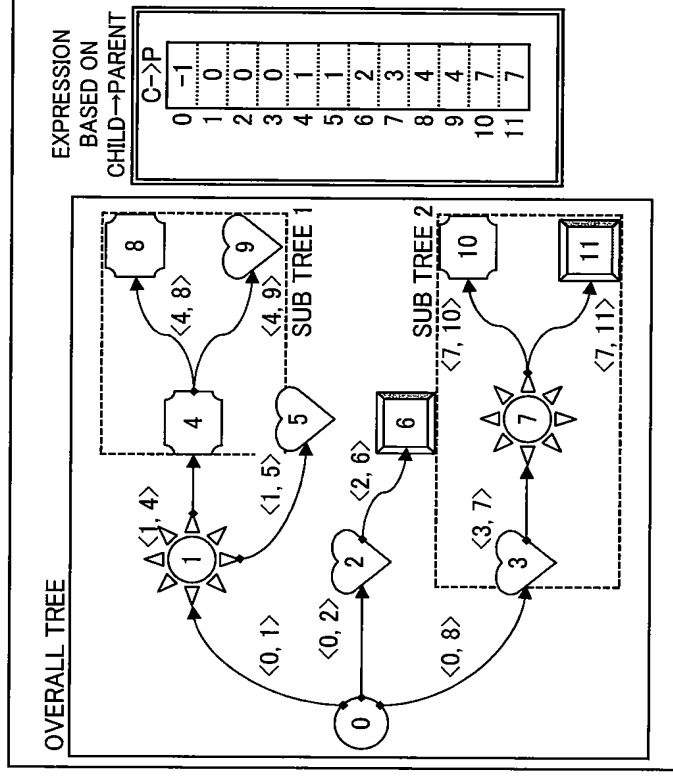




Fig.17

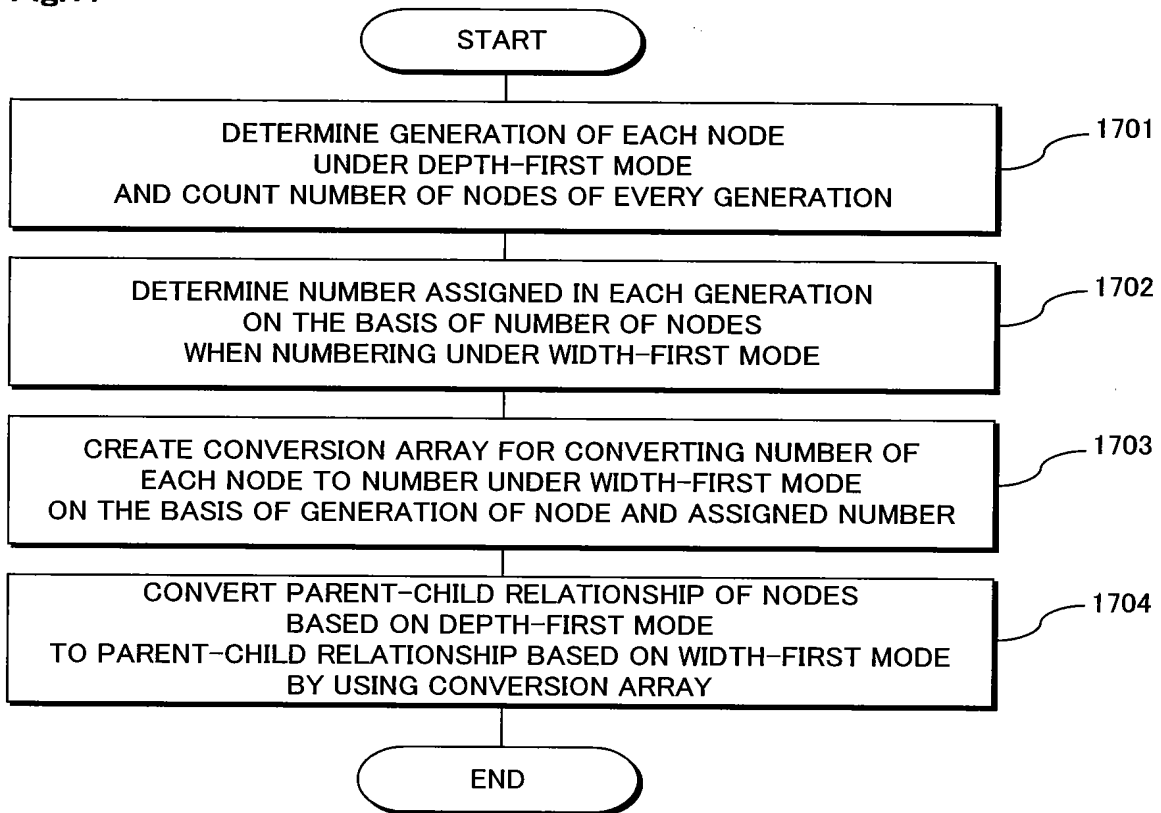


Fig.18A

PROCEDURE 0

EXPRESSION BASED ON CHILD→PARENT		
C→P	depth	depth- count
0 -1	0 -	0 0
1 0	1 -	1 0
2 1	2 -	2 0
3 2	3 -	3 0
4 2	4 -	4 0
5 1	5 -	
6 0	6 -	
7 6	7 -	
8 0	8 -	
9 8	9 -	
10 9	10 -	
11 9	11 -	

Fig.18B

PROCEDURE 1

EXPRESSION BASED ON CHILD→PARENT		
C→P	depth	depth- count
0 -1	0 -->0	0 0->1
1 0	1 -	1 0
2 1	2 -	2 0
3 2	3 -	3 0
4 2	4 -	4 0
5 1	5 -	
6 0	6 -	
7 6	7 -	
8 0	8 -	
9 8	9 -	
10 9	10 -	
11 9	11 -	

Fig.18C

PROCEDURE 2

EXPRESSION BASED ON CHILD→PARENT		
C→P	depth	depth- count
0 -1	0 0*	0 1
1 0	1 -->1	1 0->1
2 1	2 -	2 0
3 2	3 -	3 0
4 2	4 -	4 0
5 1	5 -	
6 0	6 -	
7 6	7 -	
8 0	8 -	
9 8	9 -	
10 9	10 -	
11 9	11 -	

Fig.19A

PROCEDURE 3

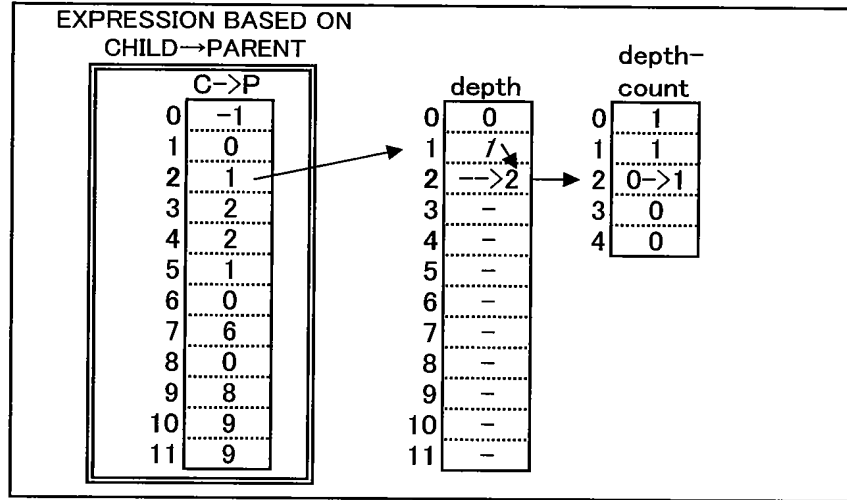


Fig.19B

PROCEDURE 4

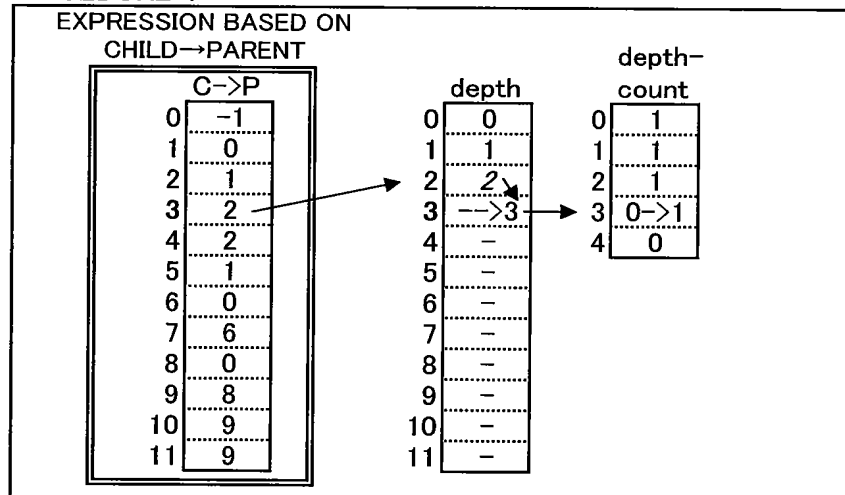


Fig.19C

PROCEDURE 5

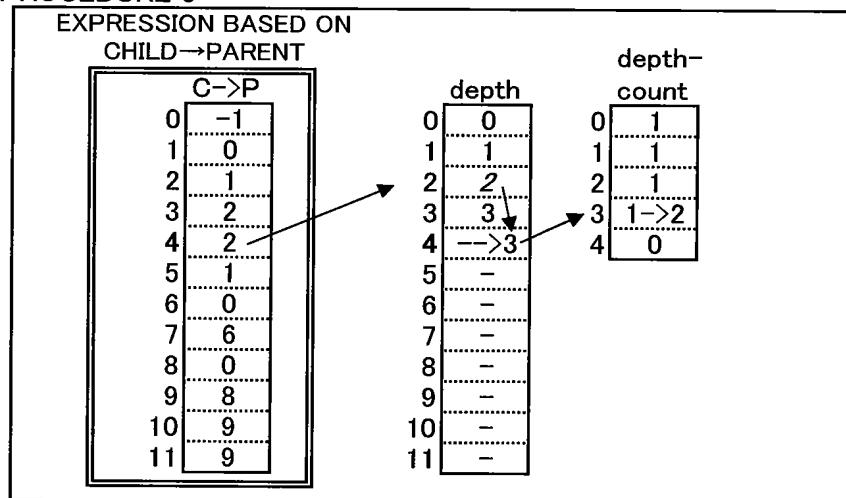


Fig.20A

## PROCEDURE 6

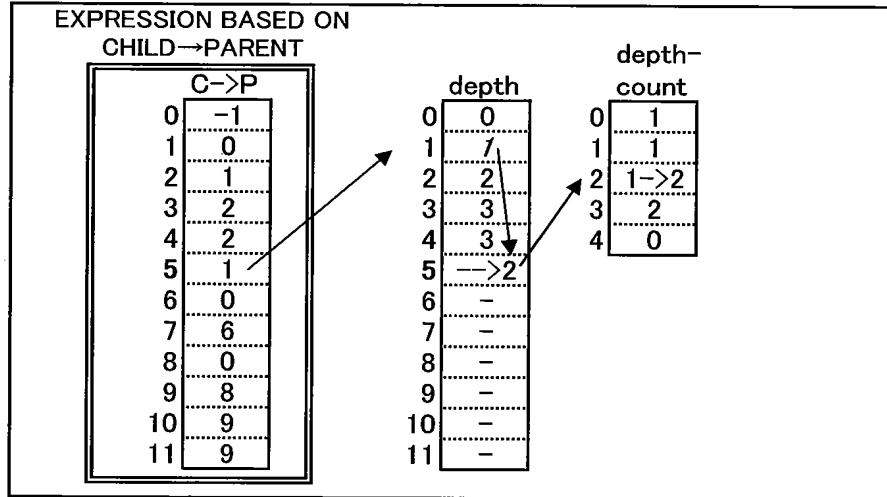


Fig.20B

## PROCEDURE 7

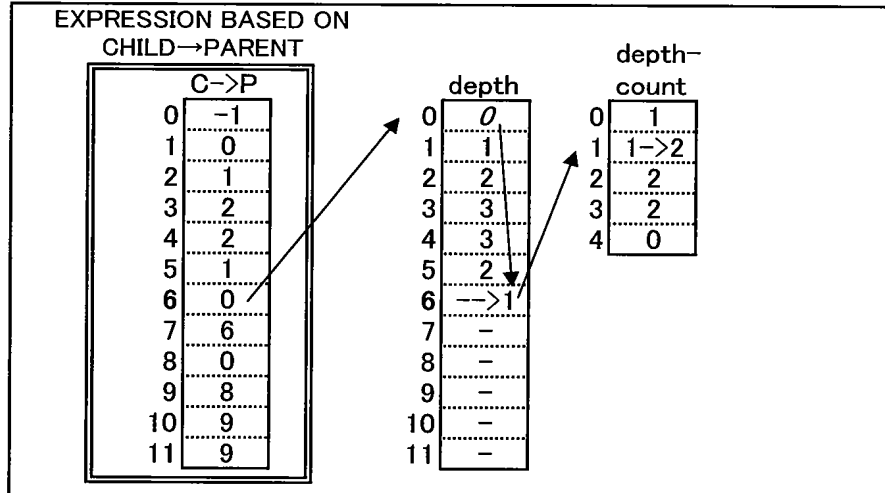


Fig.20C

## PROCEDURE 8

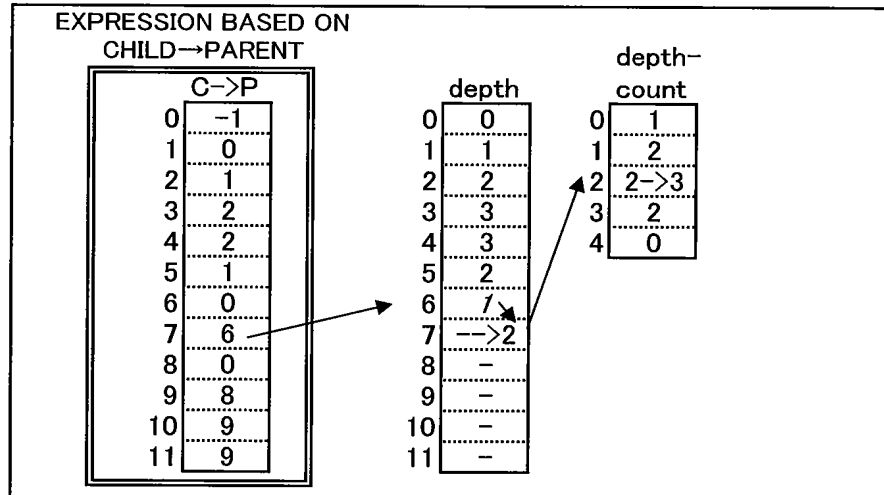


Fig.21A

PROCEDURE 9

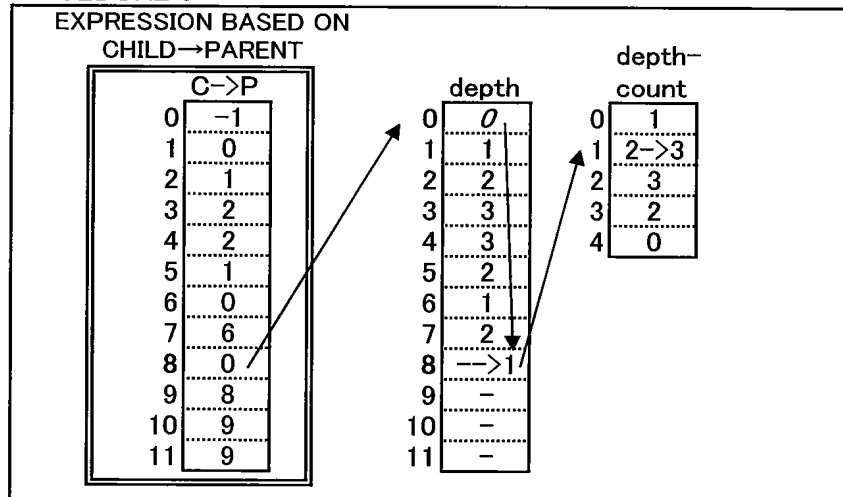


Fig.21B

PROCEDURE 10

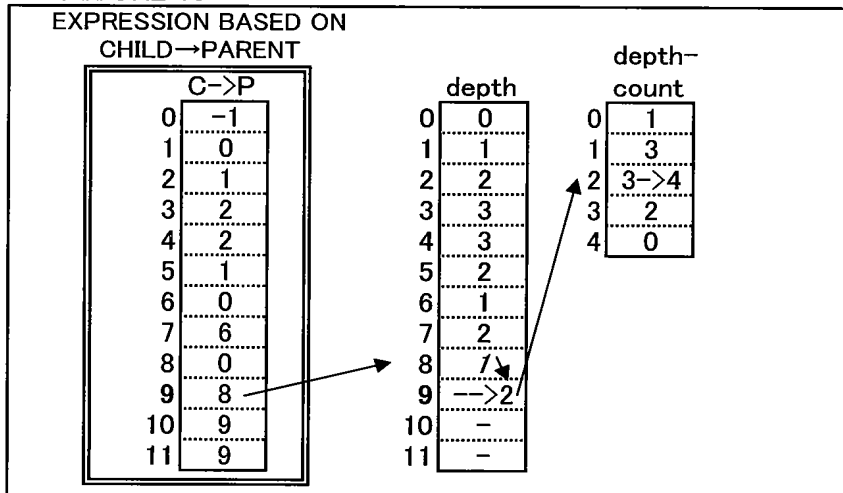


Fig.21C

PROCEDURE 11

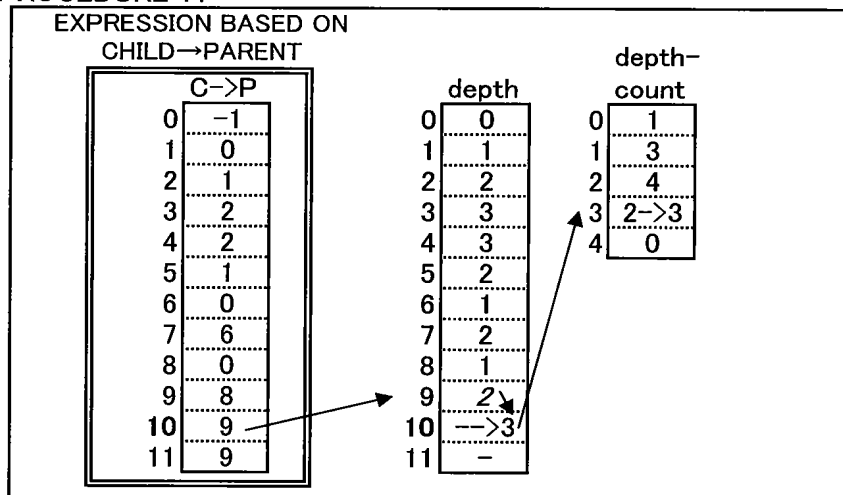


Fig.22

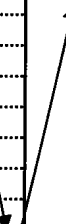
PROCEDURE 12

EXPRESSION BASED ON  
CHILD→PARENT

C→P	
0	-1
1	0
2	1
3	2
4	2
5	1
6	0
7	6
8	0
9	8
10	9
11	9

depth	
0	0
1	1
2	2
3	3
4	3
5	2
6	1
7	2
8	1
9	2
10	3
11	-->3

depth- count	
0	1
1	3
2	4
3	3->4
4	0



**Fig.23**

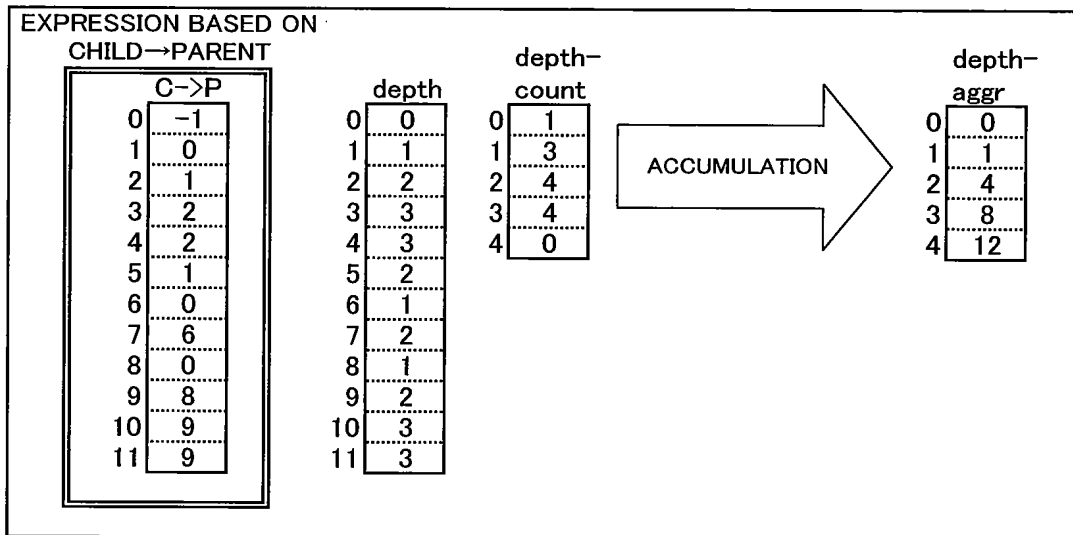


Fig.24A

## PROCEDURE 0

DEPTH-FIRST EXPRESSION BASED ON CHILD→PARENT				CONVERSION DEFINITION OF "No."	
C→P		depth	depth- aggr		
0	-1	0	0	0	-
1	0	1	1	1	-
2	1	2	2	2	-
3	2	3	3	3	-
4	2	4	3	4	-
5	1	5	2	5	-
6	0	6	1	6	-
7	6	7	2	7	-
8	0	8	1	8	-
9	8	9	2	9	-
10	9	10	3	10	-
11	9	11	3	11	-

Fig.24B

## PROCEDURE 1

DEPTH-FIRST EXPRESSION BASED ON CHILD→PARENT				CONVERSION DEFINITION OF "No."	
C→P		depth	depth- aggr		
0	-1	0	0→1	0	-->0
1	0	1	1	1	-
2	1	2	2	2	4
3	2	3	3	3	8
4	2	4	3	4	12
5	1	5	2		
6	0	6	1		
7	6	7	2		
8	0	8	1		
9	8	9	2		
10	9	10	3		
11	9	11	3		

Fig.24C

## PROCEDURE 2

DEPTH-FIRST EXPRESSION BASED ON CHILD→PARENT				CONVERSION DEFINITION OF "No."	
C→P		depth	depth- aggr		
0	-1	0	0	0	0
1	0	1	1	1	--> 1
2	1	2	2	2	-
3	2	3	3	3	-
4	2	4	3	4	-
5	1	5	2	5	-
6	0	6	1	6	-
7	6	7	2	7	-
8	0	8	1	8	-
9	8	9	2	9	-
10	9	10	3	10	-
11	9	11	3	11	-



Fig.25A

## PROCEDURE 3

DEPTH-FIRST EXPRESSION BASED ON CHILD→PARENT				CONVERSION DEFINITION OF "No."	
C→P		depth	depth- aggr		
0	-1	0	0	0	0
1	0	1	1	1	1
2	1	2	2	2	-->4
3	2	3	3	3	-
4	2	4	3	4	-
5	1	5	2	5	-
6	0	6	1	6	-
7	6	7	2	7	-
8	0	8	1	8	-
9	8	9	2	9	-
10	9	10	3	10	-
11	9	11	3	11	-

Fig.25B

## PROCEDURE 4

DEPTH-FIRST EXPRESSION BASED ON CHILD→PARENT				CONVERSION DEFINITION OF "No."
C→P		depth	depth- aggr	
0	-1	0	0	0
1	0	1	1	1
2	1	2	2	2
3	2	3	3	3
4	2	4	3	4
5	1	5	2	5
6	0	6	1	6
7	6	7	2	7
8	0	8	1	8
9	8	9	2	9
10	9	10	3	10
11	9	11	3	11

Fig.25C

## PROCEDURE 5

DEPTH-FIRST EXPRESSION BASED ON CHILD→PARENT				CONVERSION DEFINITION OF "No."
C→P		depth	depth- aggr	
0	-1	0	0	0
1	0	1	1	1
2	1	2	2	2
3	2	3	3	3
4	2	4	3	4
5	1	5	2	5
6	0	6	1	6
7	6	7	2	7
8	0	8	1	8
9	8	9	2	9
10	9	10	3	10
11	9	11	3	11

0	1
1	2
2	5
3	9→10
4	12

0	0
1	1
2	4
3	8
4	--→9
5	-
6	-
7	-
8	-
9	-
10	-
11	-

Fig.26A

PROCEDURE 6

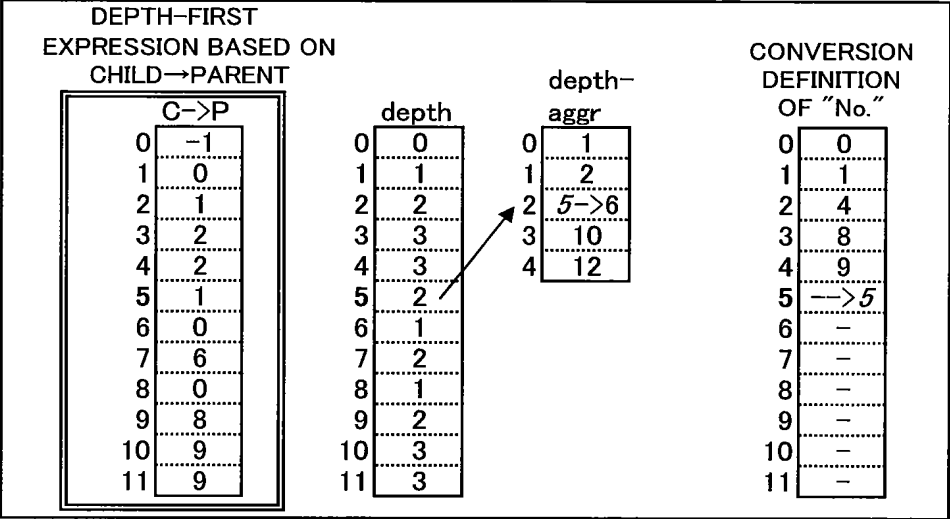


Fig.26B

PROCEDURE 7

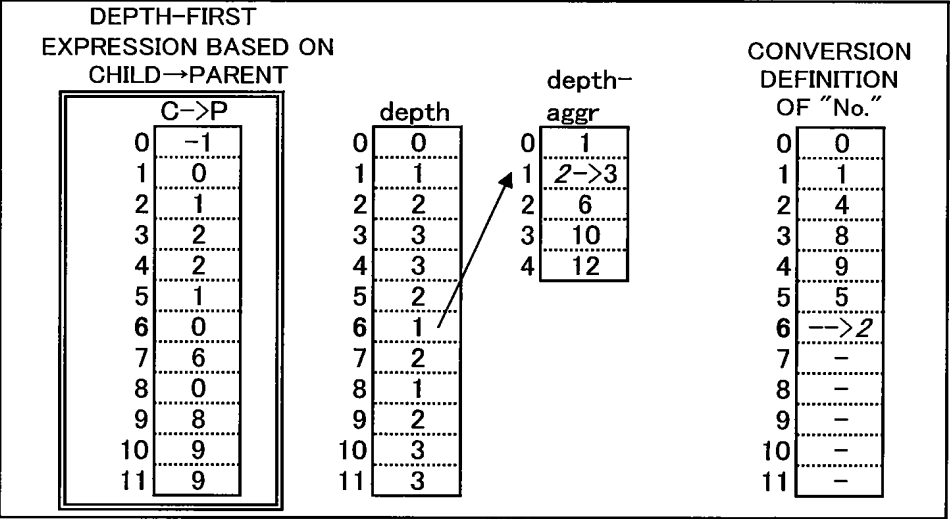


Fig.26C

PROCEDURE 8

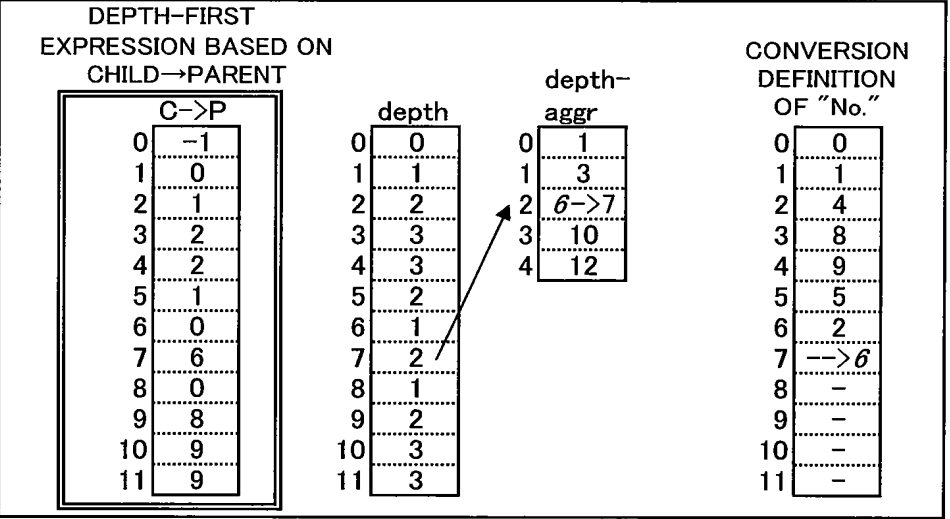


Fig.27A

## PROCEDURE 9

DEPTH-FIRST EXPRESSION BASED ON CHILD→PARENT				CONVERSION DEFINITION OF "No."
C→P		depth	depth- aggr	
0	-1	0	0	0
1	0	1	1	1
2	1	2	2	2
3	2	3	3	3
4	2	4	3	4
5	1	5	2	5
6	0	6	1	6
7	6	7	2	7
8	0	8	1	8
9	8	9	2	9
10	9	10	3	10
11	9	11	3	11

Fig.27B

## PROCEDURE 10

DEPTH-FIRST EXPRESSION BASED ON CHILD→PARENT				CONVERSION DEFINITION OF "No."
C→P		depth	depth- aggr	
0	-1	0	0	0
1	0	1	1	1
2	1	2	2	2
3	2	3	3	3
4	2	4	3	4
5	1	5	2	5
6	0	6	1	6
7	6	7	2	7
8	0	8	1	8
9	8	9	2	9
10	9	10	3	10
11	9	11	3	11

Fig.27C

## PROCEDURE 11

DEPTH-FIRST EXPRESSION BASED ON CHILD→PARENT				CONVERSION DEFINITION OF "No."
C→P		depth	depth- aggr	
0	-1	0	0	0
1	0	1	1	1
2	1	2	2	2
3	2	3	3	3
4	2	4	3	4
5	1	5	2	5
6	0	6	1	6
7	6	7	2	7
8	0	8	1	8
9	8	9	2	9
10	9	10	3	10
11	9	11	3	11

Fig.28

PROCEDURE 12

DEPTH-FIRST  
EXPRESSION BASED ON  
CHILD→PARENT

C→P	
0	-1
1	0
2	1
3	2
4	2
5	1
6	0
7	6
8	0
9	8
10	9
11	9

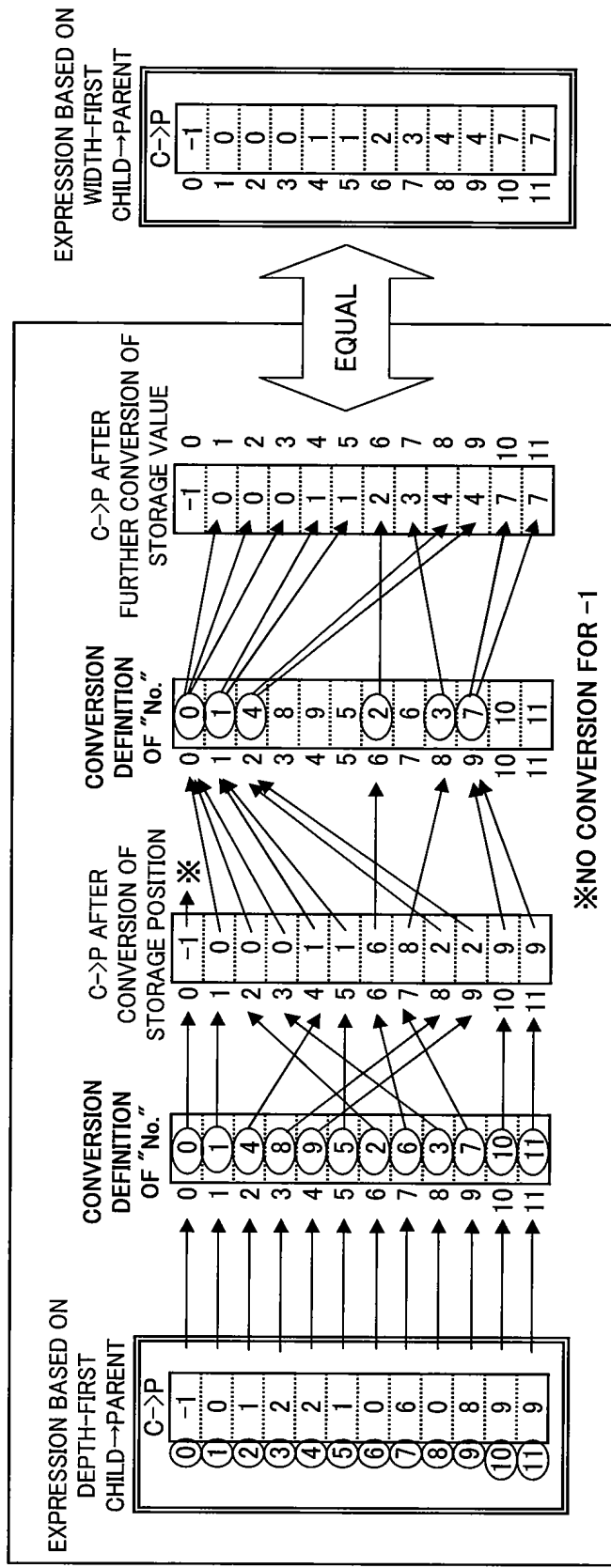
depth	
0	0
1	1
2	2
3	3
4	3
5	2
6	1
7	2
8	1
9	2
10	3
11	3

depth- aggr	
0	1
1	4
2	8
3	//→12
4	12

CONVERSION  
DEFINITION  
OF "No."

0	0
1	1
2	4
3	8
4	9
5	5
6	2
7	6
8	3
9	7
10	10
11	-> //

Fig.29





**Fig.31**

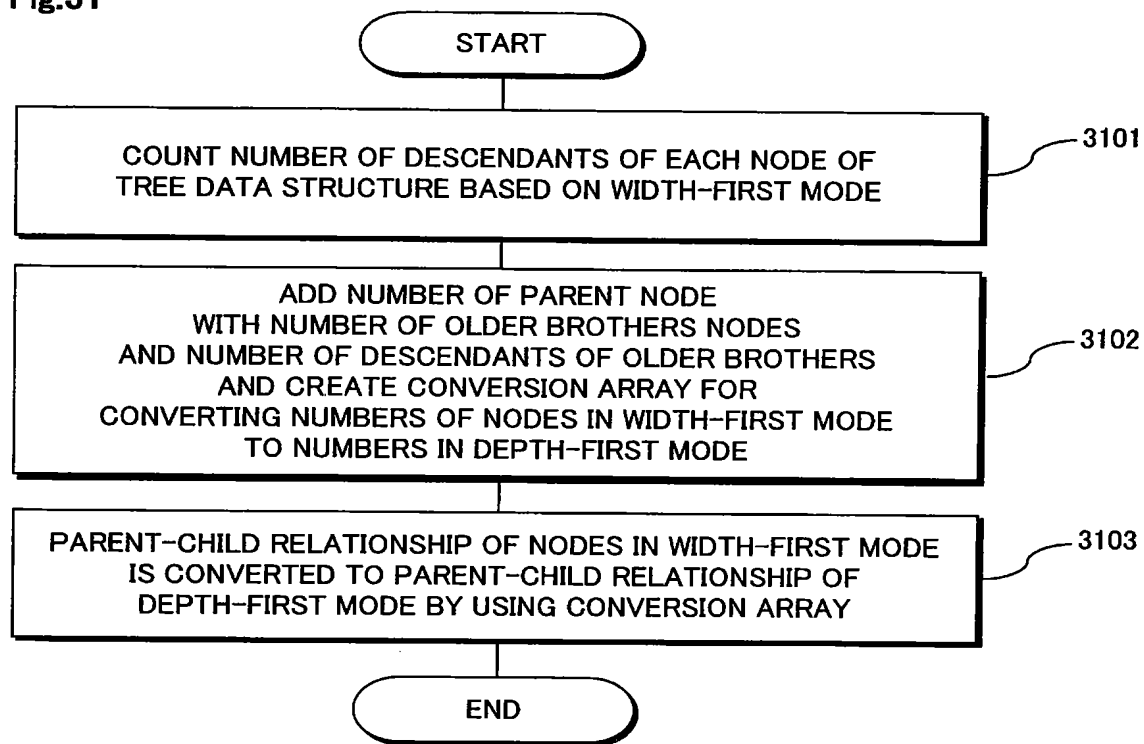


Fig.32

EXPRESSION BASED ON WIDTH-FIRST CHILD→PARENT		NODE NUMBER ARRAY	
C→P		ARRAY	
0	-1	0	1
1	0	1	1
2	0	2	1
3	0	3	1
4	1	4	1
5	1	5	1
6	2	6	1
7	3	7	1
8	4	8	1
9	4	9	1
10	7	10	1
11	7	11	1



Fig. 33

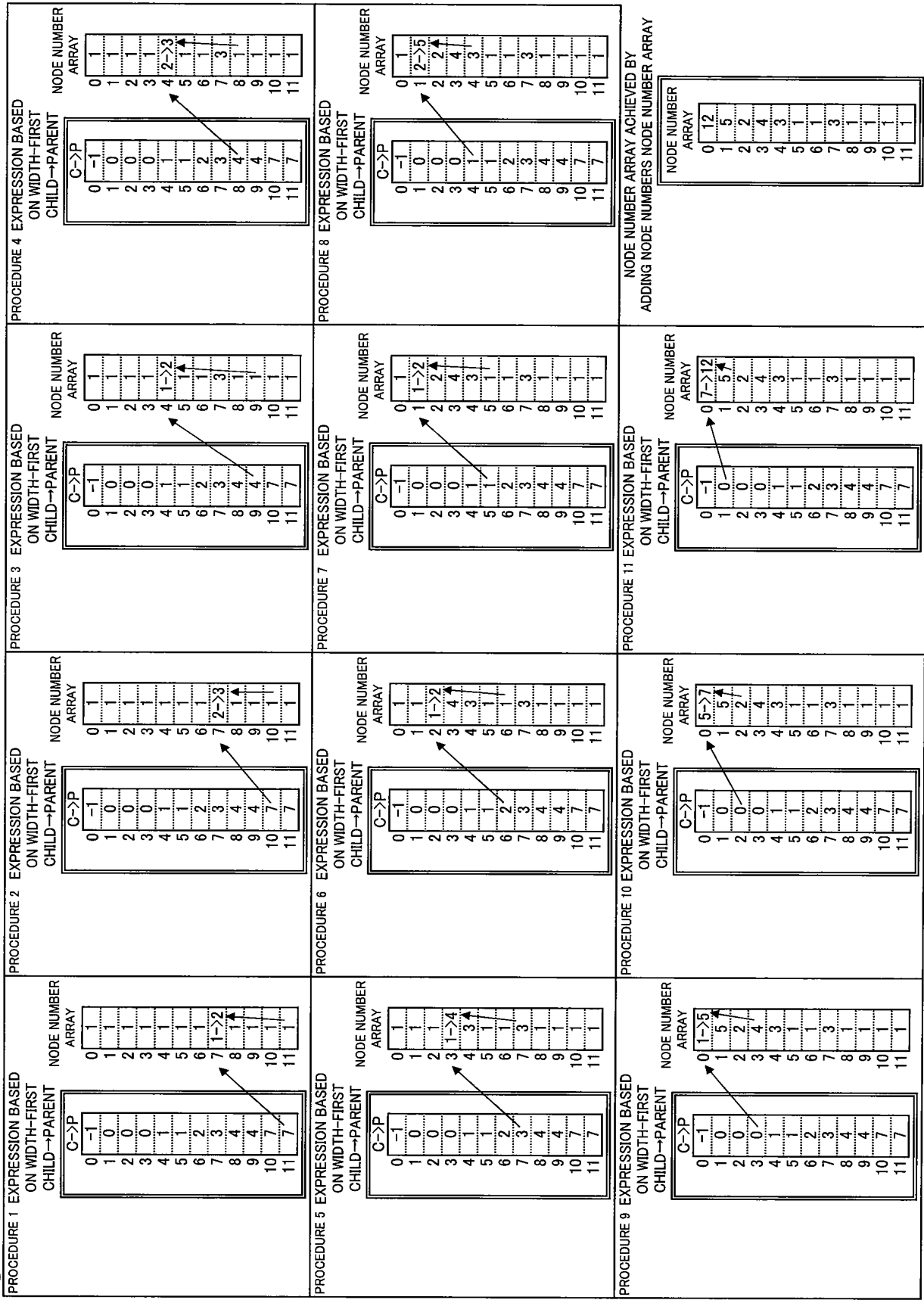


Fig.34

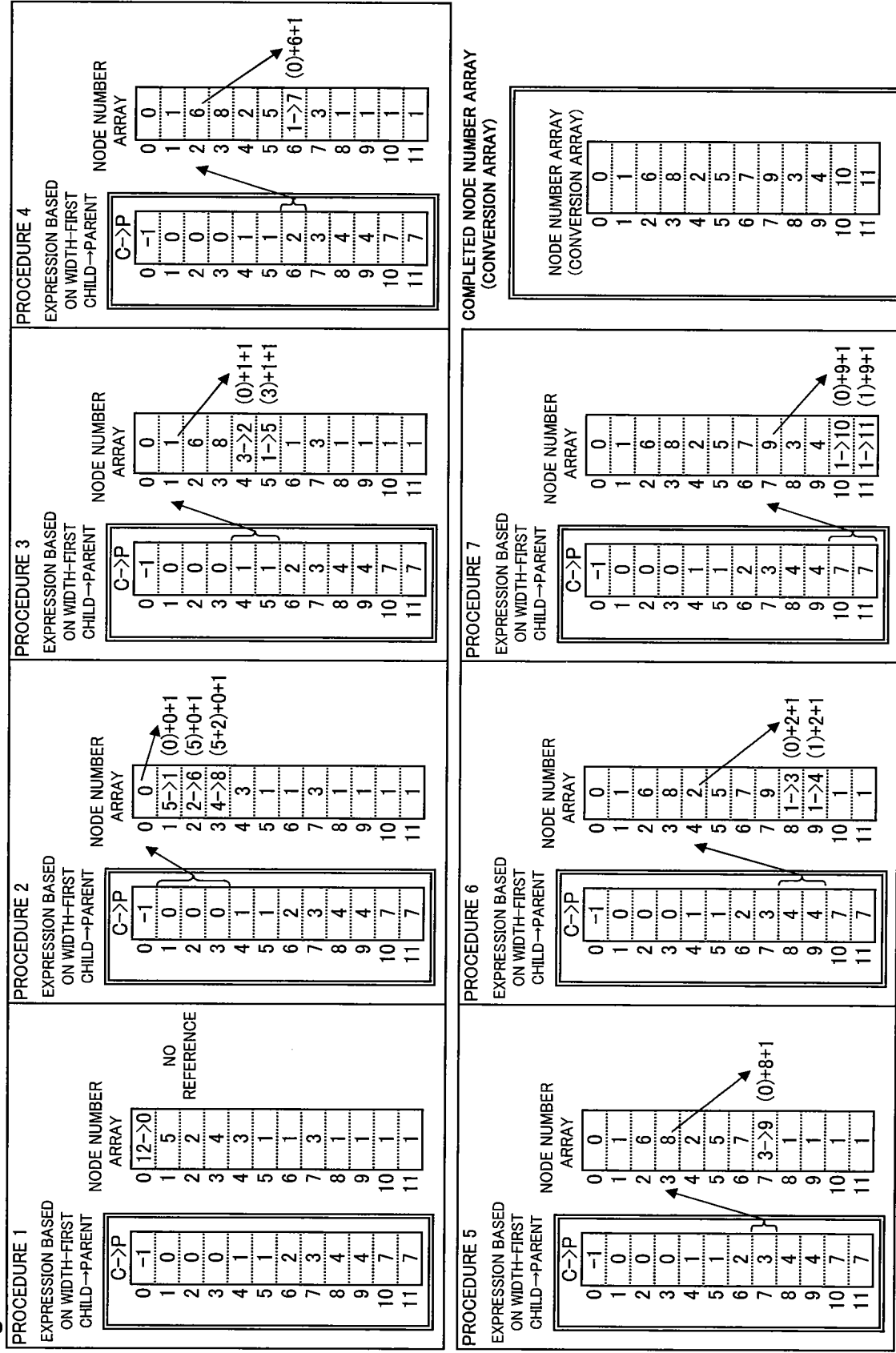


Fig.35

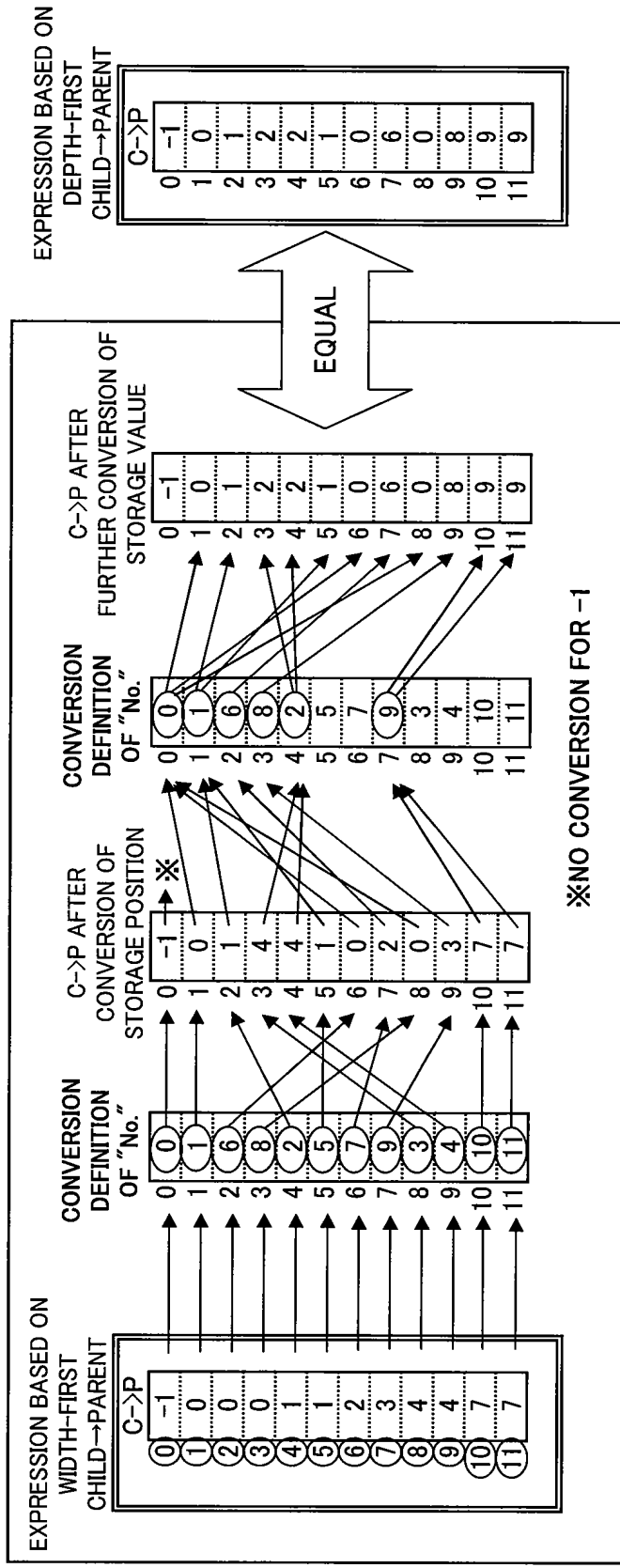


Fig.36

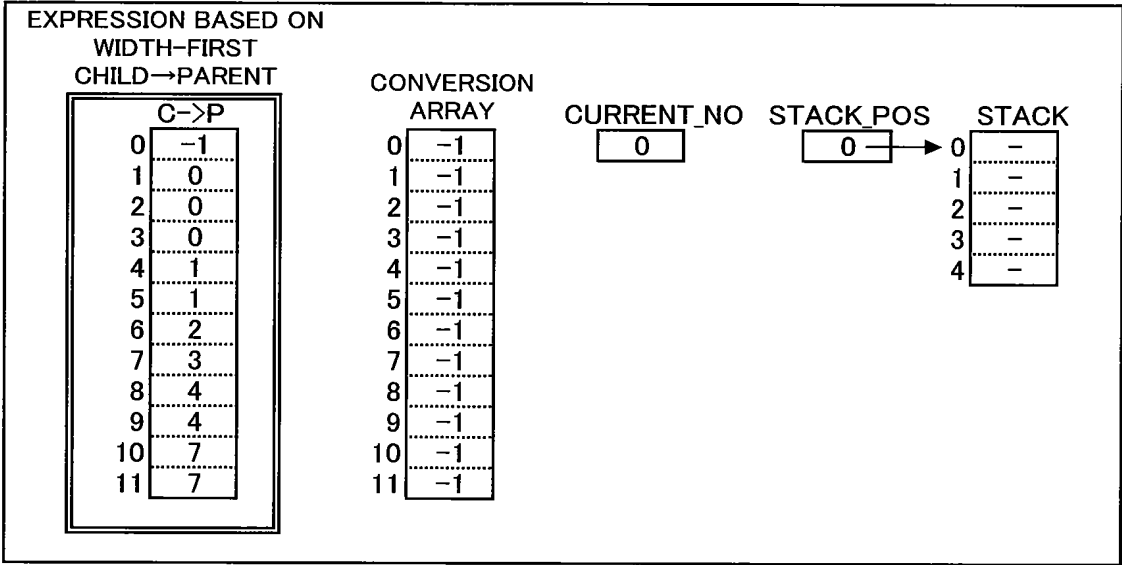


Fig.37A

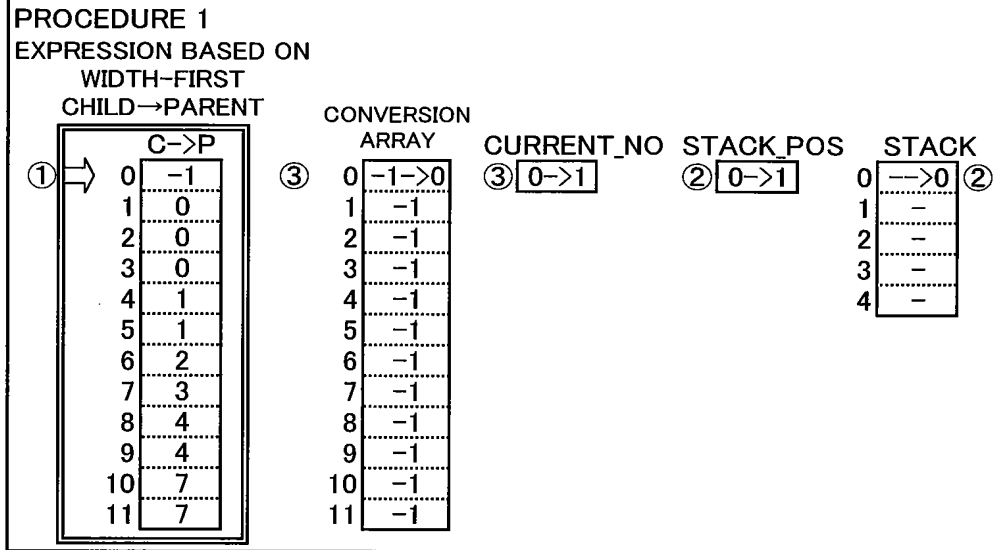


Fig.37B

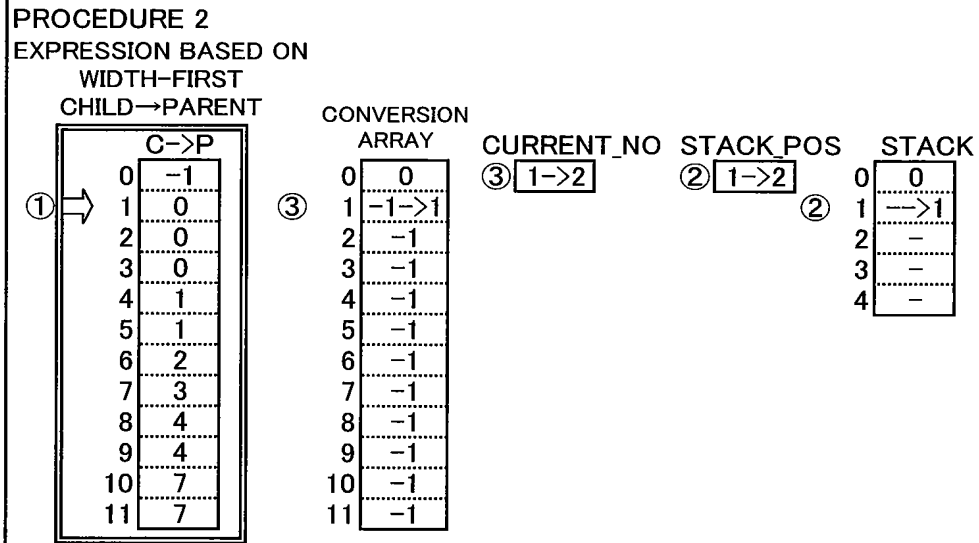


Fig.37C

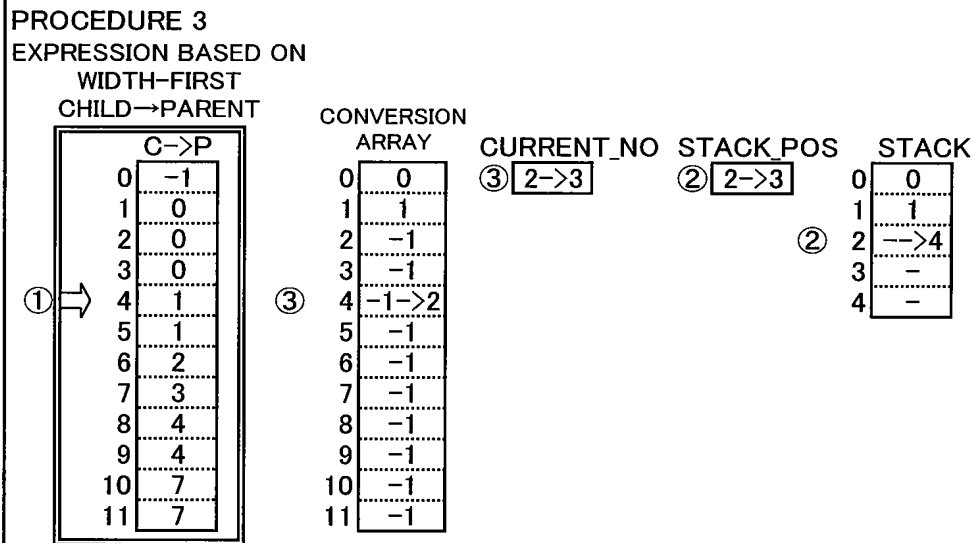


Fig.38A

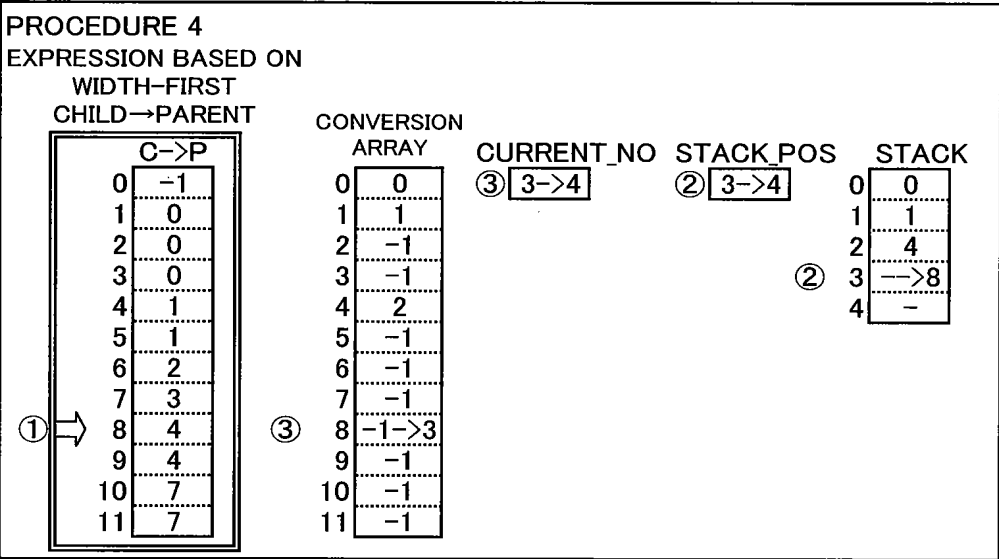


Fig.38B

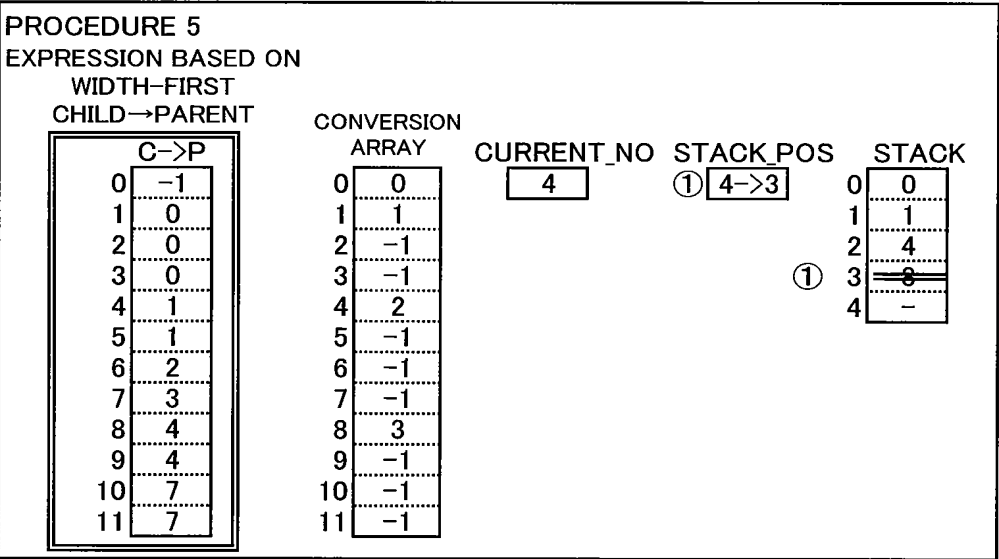


Fig.38C

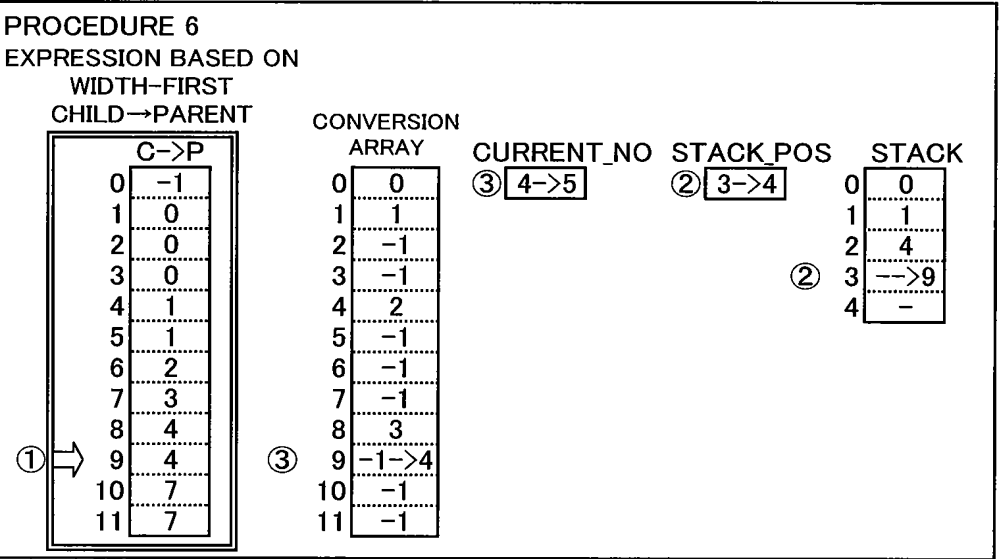


Fig.39A

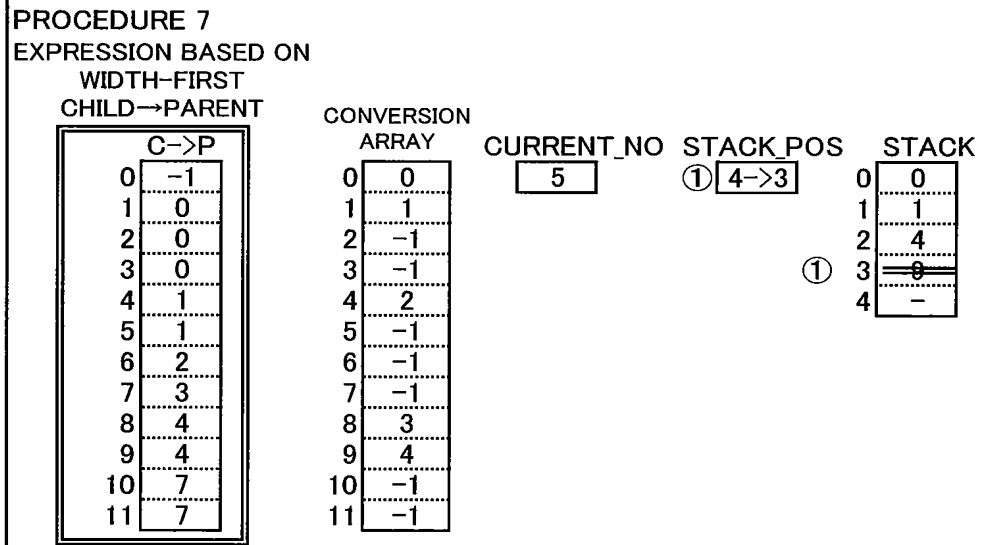


Fig.39B

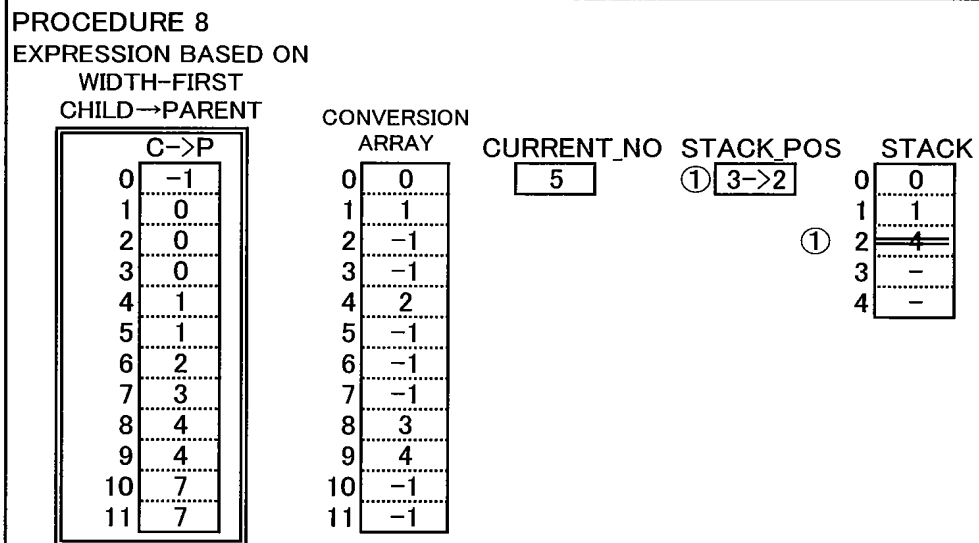


Fig.39C

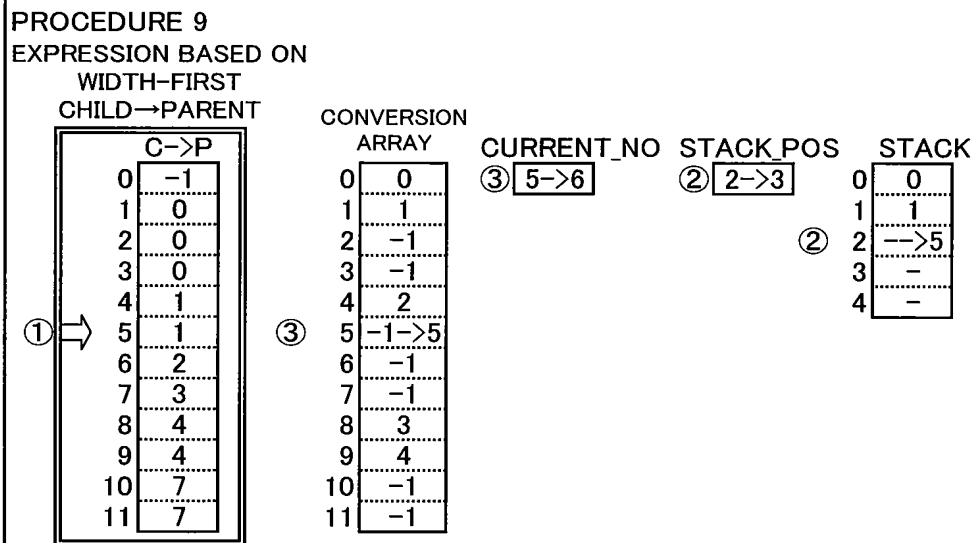


Fig.40A

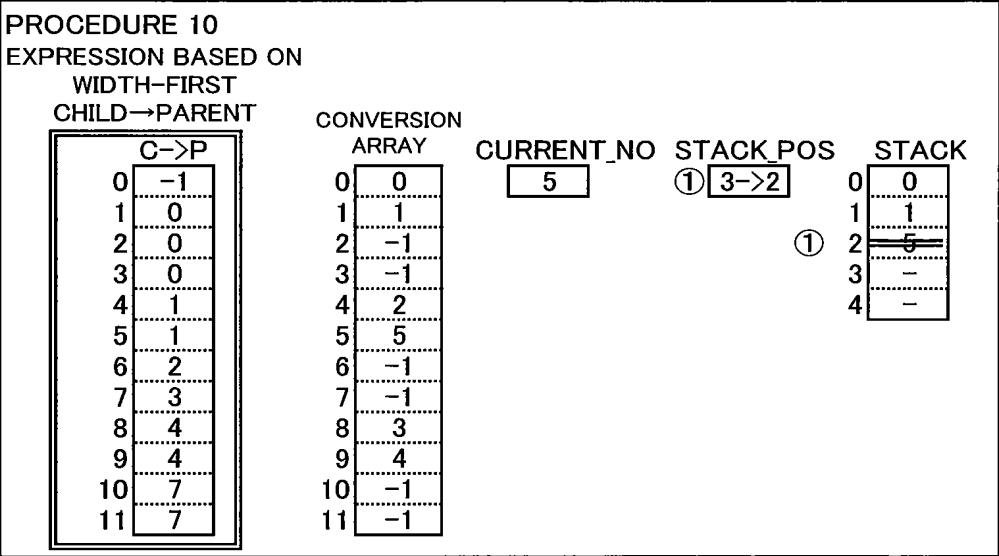


Fig.40B

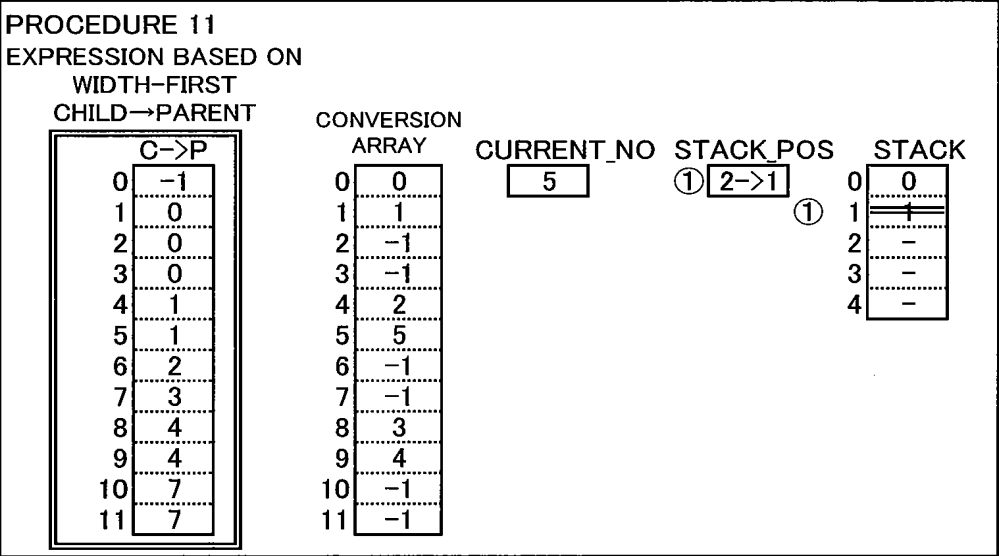


Fig.40C

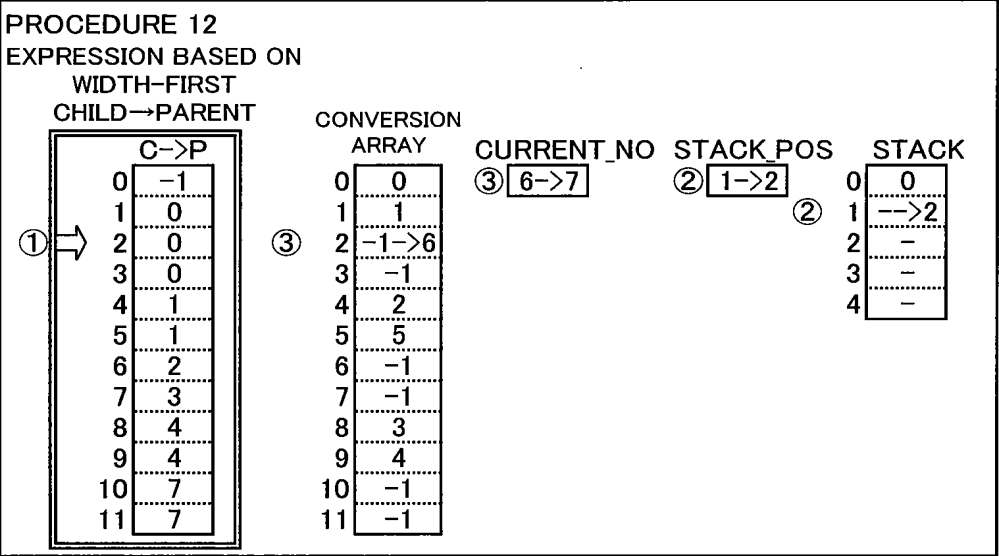




Fig.41A

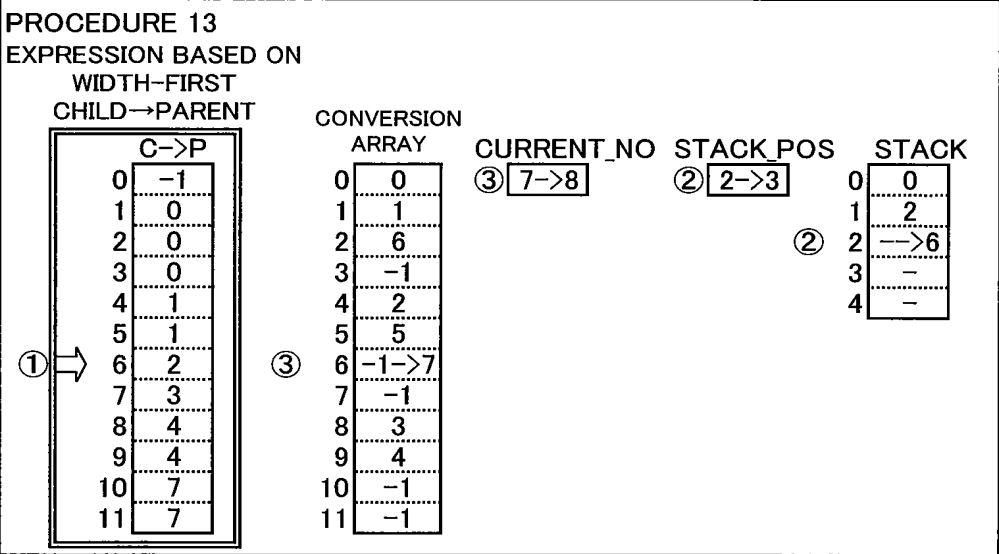


Fig.41B

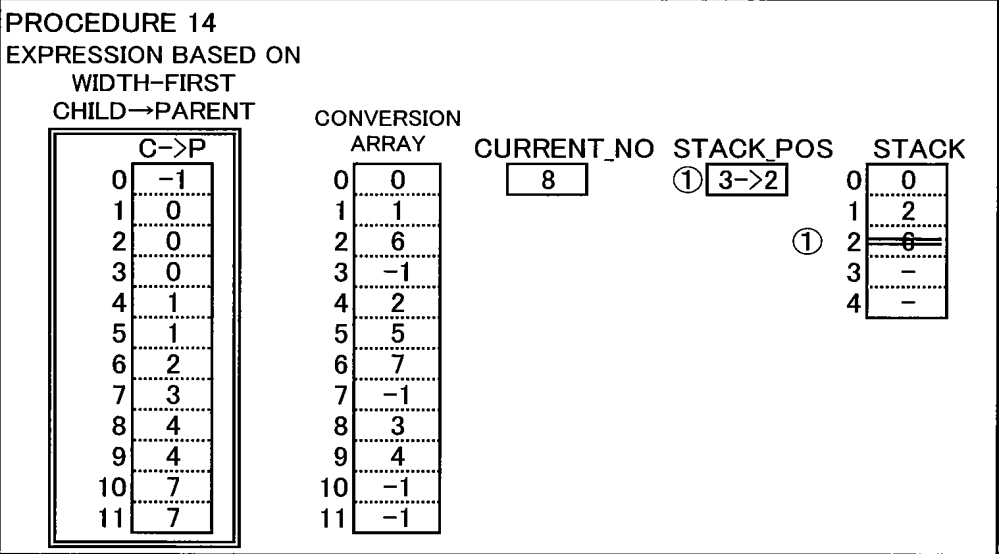


Fig.41C

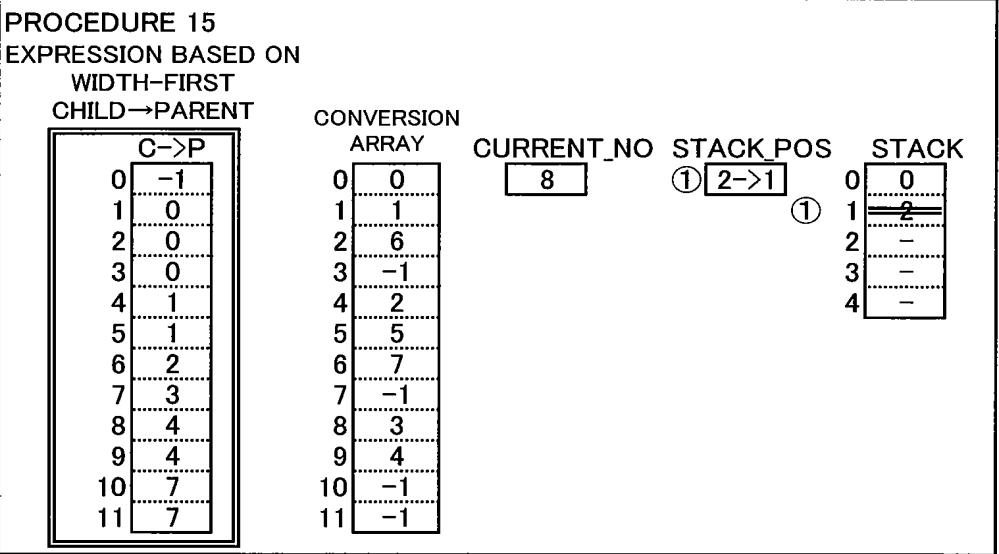


Fig.42A

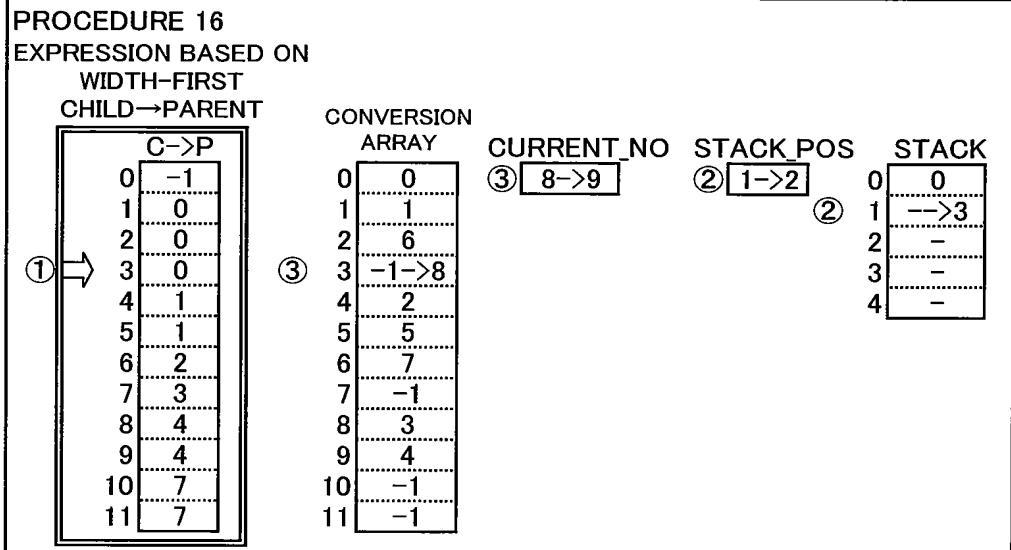


Fig.42B

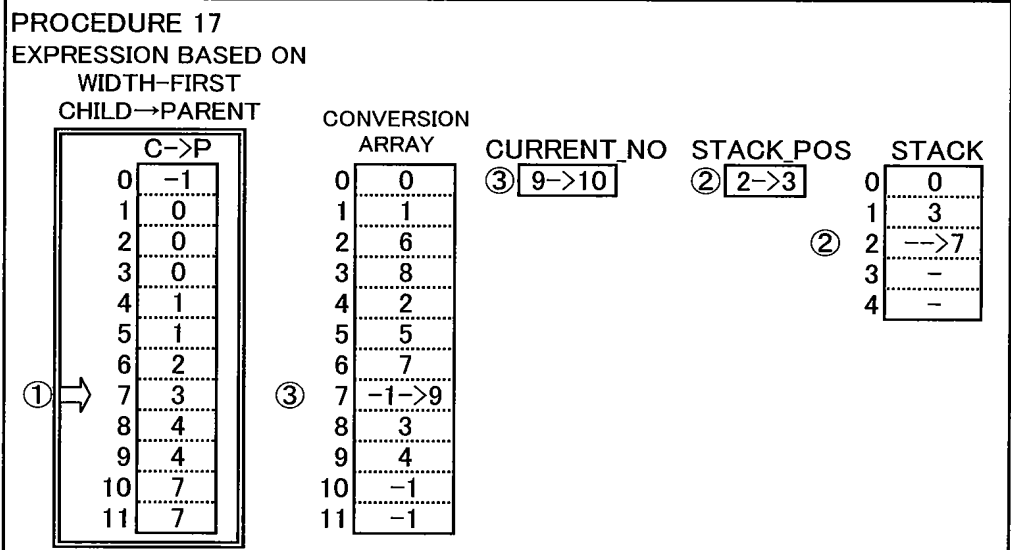


Fig.42C

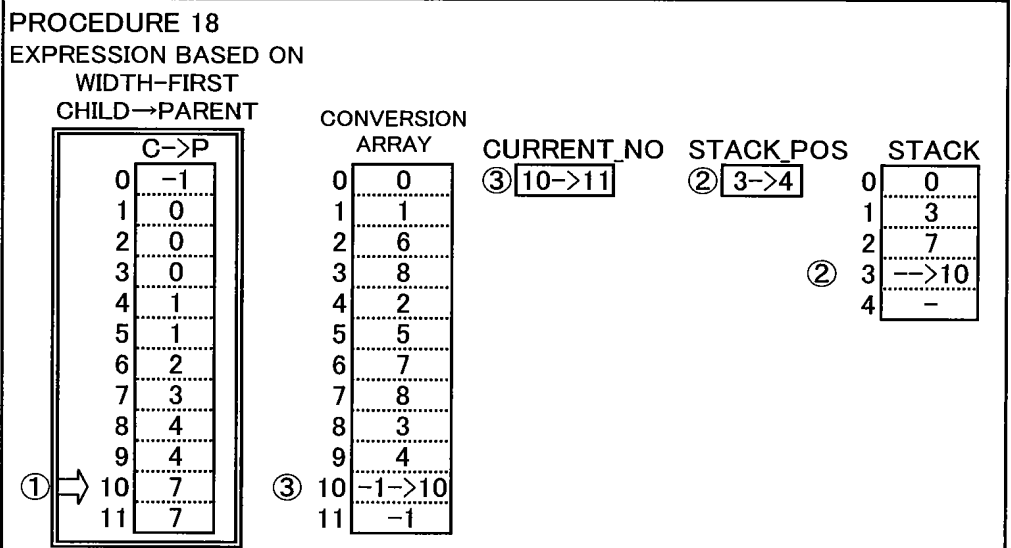


Fig.43A

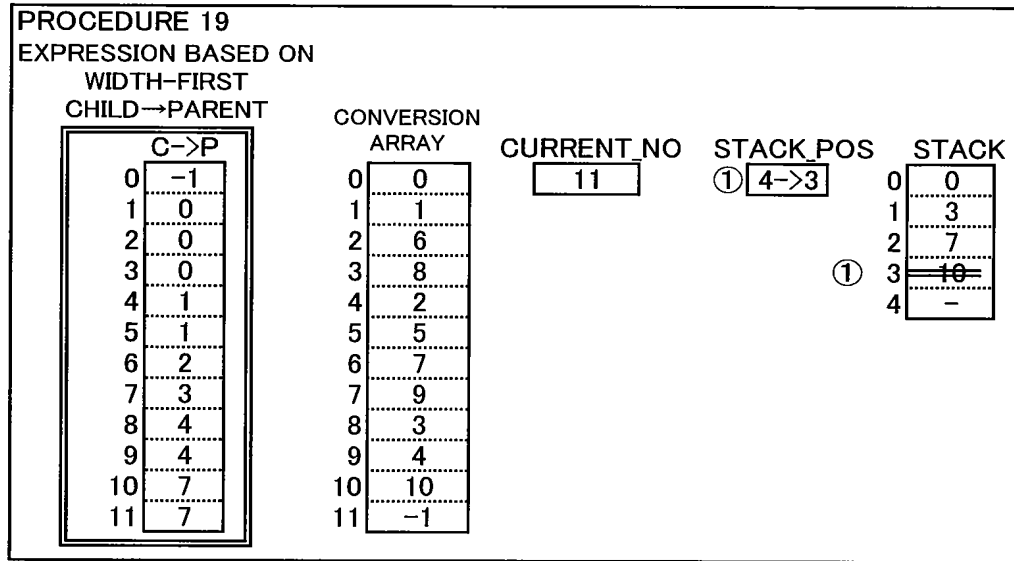


Fig.43B

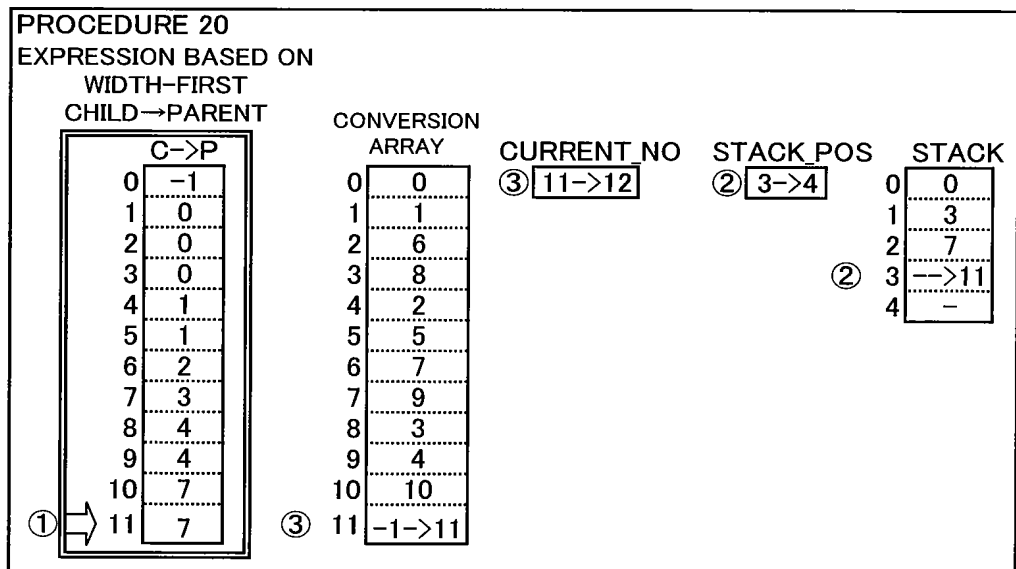


Fig.44

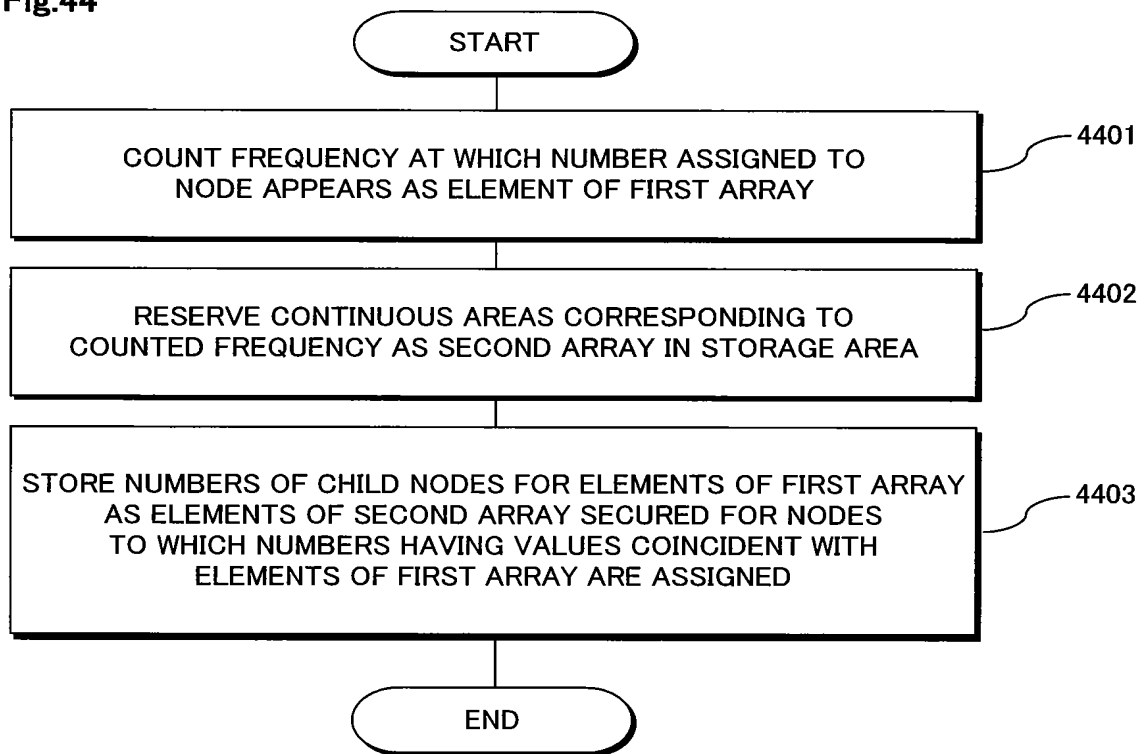


Fig.45A

OVERALL TREE

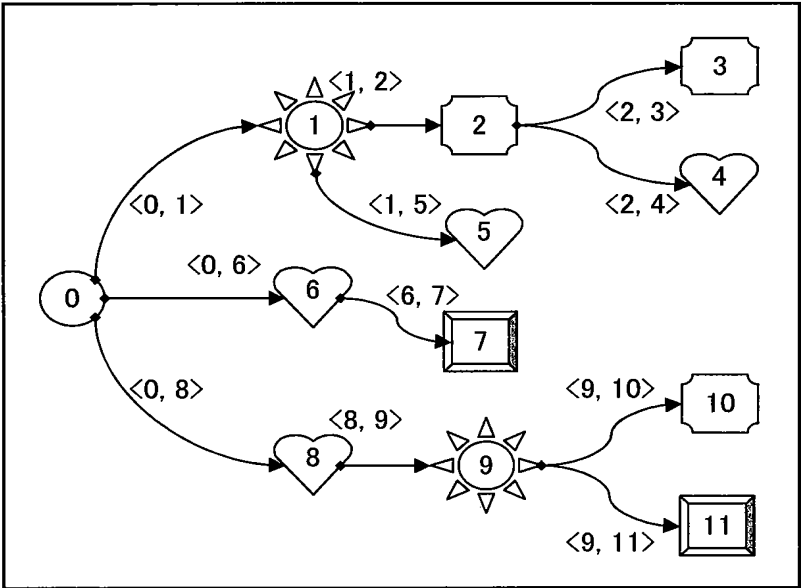


Fig.45B

EXPRESSION BASED ON  
CHILD→PARENT

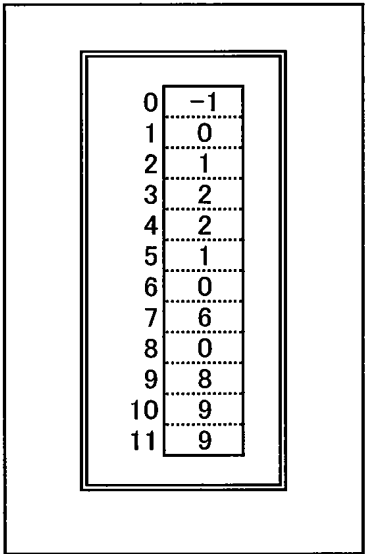
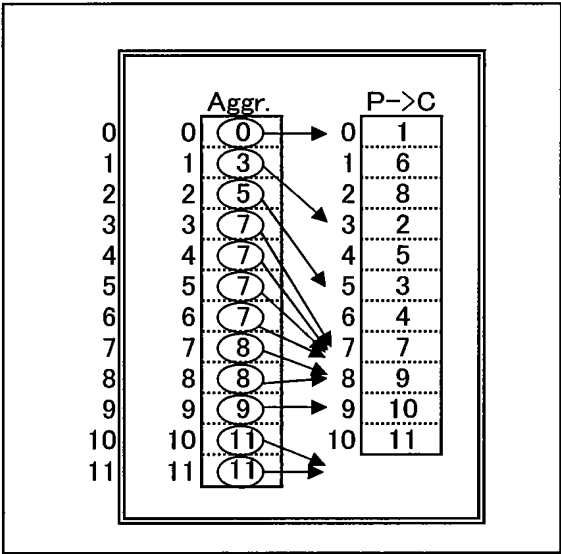


Fig.45C

EXPRESSION BASED ON  
PARENT→CHILD



**Fig.46A**

**PROCEDURE 1: RESERVATION OF AREA AND INITIALIZATION**

EXPRESSION BASED ON  
CHILD→PARENT

C→P		Aggr		P→C	
0	-1	0	0	0	-1
1	0	1	0	1	-1
2	1	2	0	2	-1
3	2	3	0	3	-1
4	2	4	0	4	-1
5	1	5	0	5	-1
6	0	6	0	6	-1
7	6	7	0	7	-1
8	0	8	0	8	-1
9	8	9	0	9	-1
10	9	10	0	10	-1
11	9	11	0		

**Fig.46B**

**PROCEDURE 2: COUNT OF EXISTENCE NUMBER**

EXPRESSION BASED ON  
CHILD→PARENT

C→P		Aggr		P→C	
0	-1	0	0→1	0	-1
1	0	1	0→1	1	-1
2	1	2	0	2	-1
3	2	3	0	3	-1
4	2	4	0	4	-1
5	1	5	0	5	-1
6	0	6	0	6	-1
7	6	7	0	7	-1
8	0	8	0	8	-1
9	8	9	0	9	-1
10	9	10	0	10	-1
11	9	11	0		

COMPLETION OF COUNT-UP

Aggr		P→C	
0	3	0	-1
1	2	1	-1
2	2	2	-1
3	0	3	-1
4	0	4	-1
5	0	5	-1
6	1	6	-1
7	0	7	-1
8	1	8	-1
9	2	9	-1
10	0	10	-1
11	0		

**Fig.46C**

**PROCEDURE 3: CONVERSION OF EXISTENCE NUMBER TO ACCUMULATIVE TOTAL**

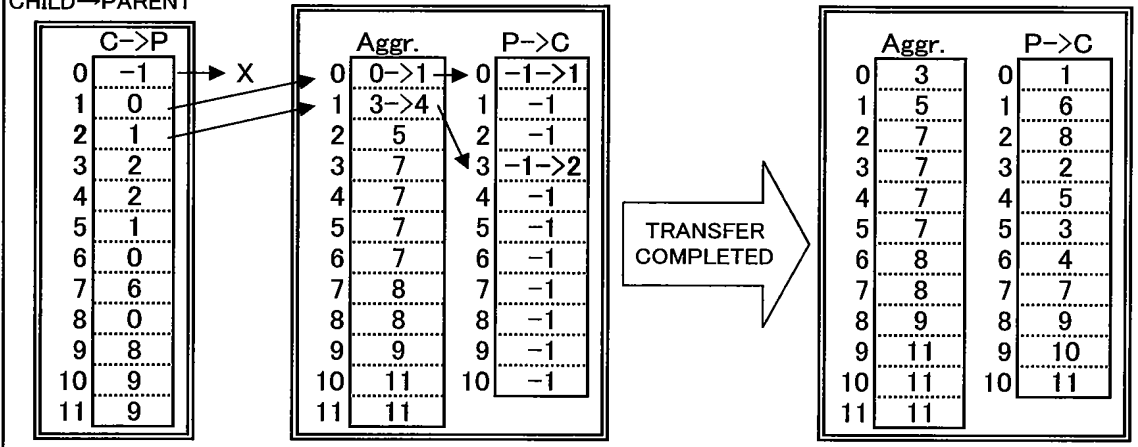
EXPRESSION BASED ON  
CHILD→PARENT

C→P		Aggr		Aggr		P→C	
0	-1	0	3	0	0	0	-1
1	0	1	2	1	3	1	-1
2	1	2	2	2	5	2	-1
3	2	3	0	3	7	3	-1
4	2	4	0	4	7	4	-1
5	1	5	0	5	7	5	-1
6	0	6	1	6	7	6	-1
7	6	7	0	7	8	7	-1
8	0	8	1	8	8	8	-1
9	8	9	2	9	9	9	-1
10	9	10	0	10	11	10	-1
11	9	11	0	11	11		

**Fig.47A**

**PROCEDURE 4: TRANSMISSION OF NODE NUMBER**

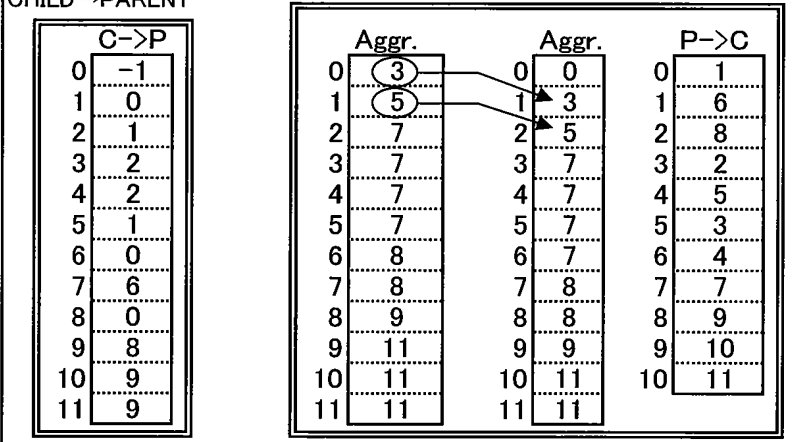
EXPRESSION BASED ON  
CHILD→PARENT



**Fig.47B**

**PROCEDURE 5: RETURN OF ARRAY Aggr TO STATE BEFORE NODE NUMBER IS TRANSFERRED**

EXPRESSION BASED ON  
CHILD→PARENT



**Fig.47C**

**CONVERSION RESULT**

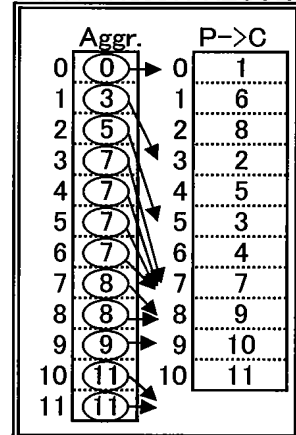


Fig.48

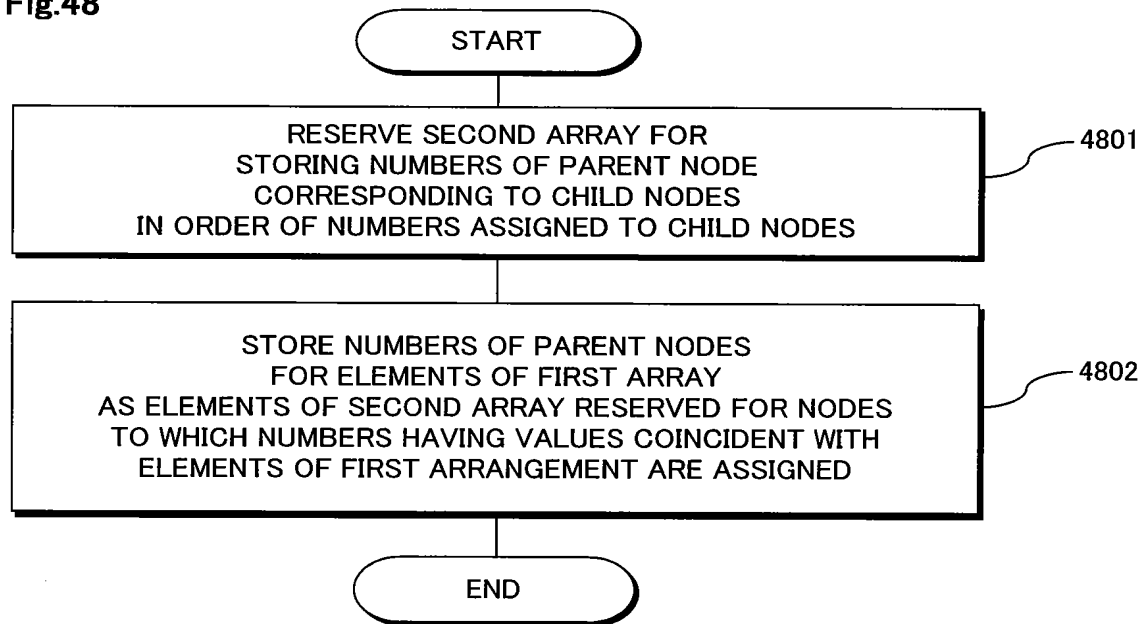




Fig.49A

PROCEDURE 1:

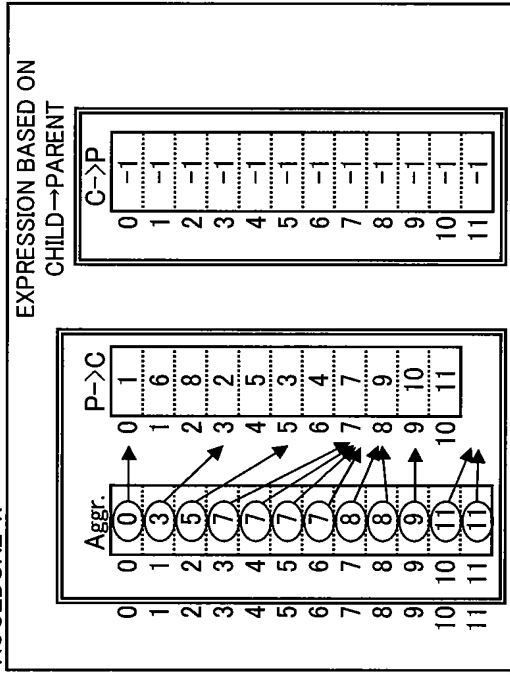


Fig.49B

PROCEDURE 2-1:

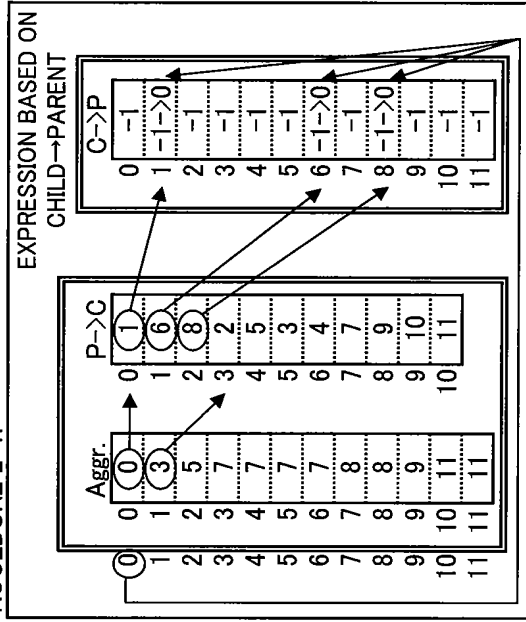


Fig.49C

PROCEDURE 2-2:

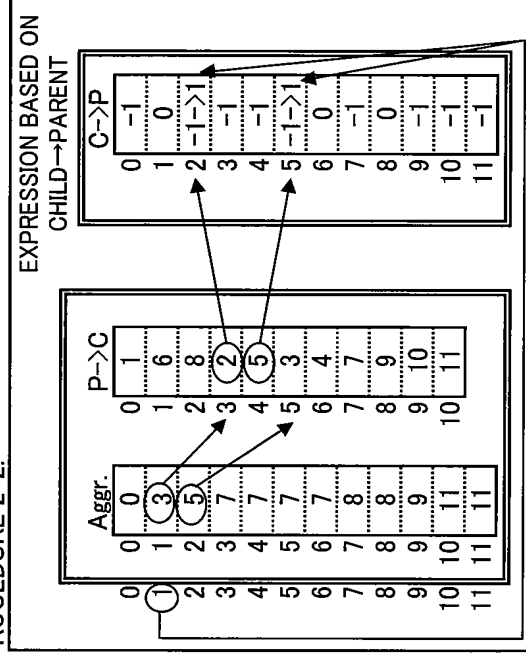


Fig.49D

FINAL RESULT  
EXPRESSION BASED ON  
CHILD  $\rightarrow$  PARENT

C $\rightarrow$ P
0
1
2
3
4
5
6
7
8
9
10
11

Fig.50

